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THE WAGES OF RISK: DETERMINING FAIR AND REASONABLE PROFIT OBJEC--ETC(U)
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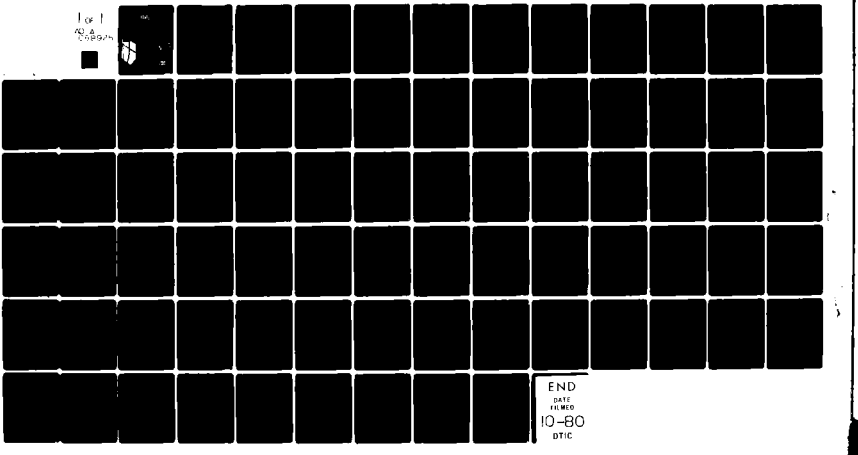

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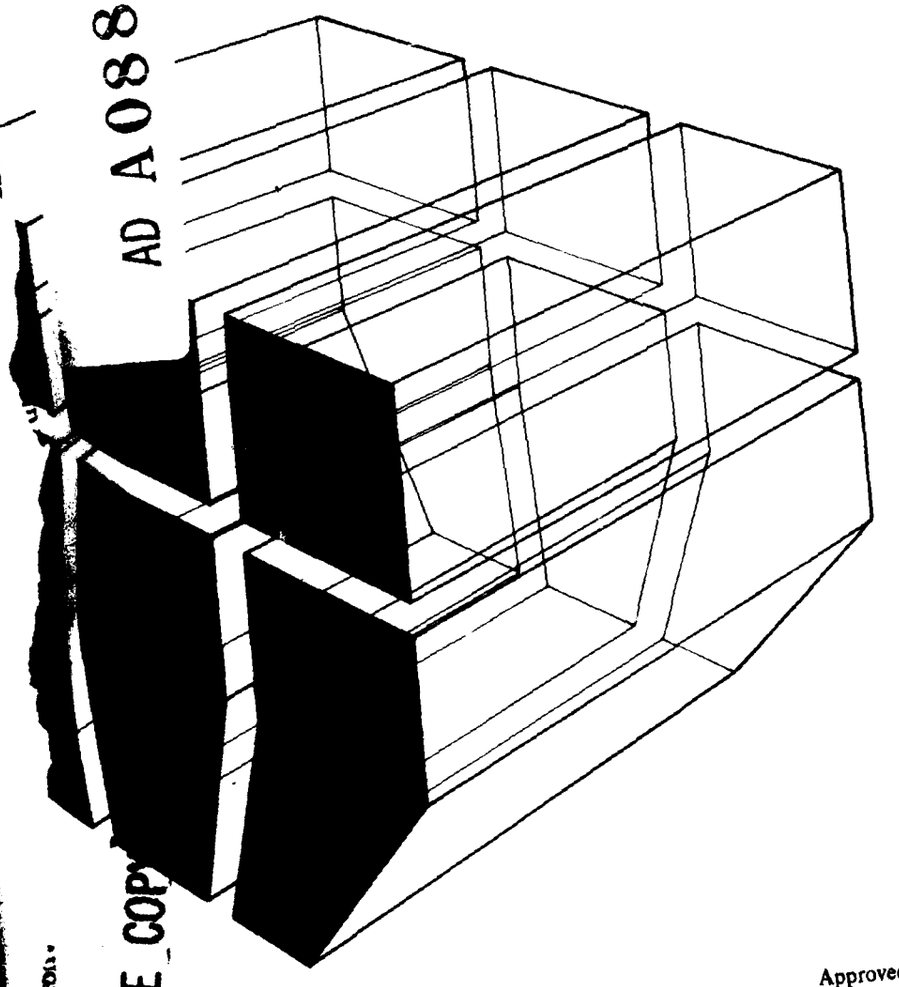
TECHNICAL REPORT P-109
August 1980

LEVEL II

THE WAGES OF RISK: DETERMINING FAIR AND REASONABLE PROFIT OBJECTIVES



by
John M. Deponai III
Nancy Grubb

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This report documents development of procedures for determining fair and reasonable profit objectives on U.S. Army Corps of Engineers contracts. The report describes and critiques several procedures that were considered during the course of the study. Finally, the recommended procedures which evolved from these earlier proposals are described and evaluated. The report recommends that profit on Corps contracts be computed by evaluating certain factors that reflect the degree of risk associated with a particular contract and a

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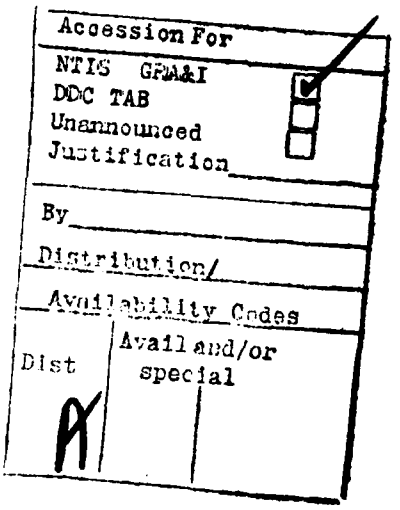
factor that provides contractors a minimum profit. In addition, this report proposes a simpler graphical method for use on architect-engineer (A-E) contracts less than $100,000.

FOREWORD

This report summarizes research conducted during FY79 for the Directorate of Military Programs, Office of the Chief of Engineers (OCE), under Intra-Army Order for Reimbursable Services Number MCC-E-78-02, "Profit Determination Procedures." The OCE Technical Monitor was Mr. Frank Parker.

The work was performed by the Facility Systems Division (FS), U.S. Army Construction Engineering Research Laboratory (CERL), Champaign, IL. The Principal Investigator was Mr. John M. Deponai III, and the Associate Investigators were Mr. Rahim Ilker Adiguzel, Dr. Carl Erikson, and Ms. Nancy Grubb. Mr. E. A. Lotz is Chief of FS.

COL L. J. Circeo is Commander and Director of CERL, and Dr. L. R. Shaffer is Technical Director.



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THE WAGES OF RISK: DETERMINING FAIR AND REASONABLE PROFIT OBJECTIVES

1 INTRODUCTION

Background

On 1 October 1976, the Office of the Chief of Engineers (OCE) requested the U.S. Army Construction Engineering Research Laboratory (CERL) to develop an improved procedure for determining a "fair and reasonable" profit on Corps contracts.

Presently, the approved profit determination procedure for Corps construction contracts is described in ER 1180-1-1, *Engineer Contract Instructions* (ECI), paragraph 3-808.[1] Guidance for the profit determination procedures to be used for architect-engineer (A-E) contracts is described in Engineer Manual (EM) 1110-345-30.[2] Another method used is included in the *Architect-Engineer Contracting Procedures and Negotiations Guide* (AECPNG).[3] Department of Defense (DOD) implementation of the EM was rescinded in June 1972 by DOD Directive 72-12 because the cost estimating methods presented were, by that time, in conflict with the Armed Services Procurement Regulation (ASPR) procedures.* Parts of that same EM are referenced, however, in paragraph 18-306.2(a) of the Army Procurement Procedure (APP).[4] The Department of the Army's APP Board will not permit the Corps to remove EM 1110-345-30 from the list of official Corps publications until the Corps replaces the profit determination procedures presented in that manual.

In FY77, CERL analyzed the profit determination factors and defined a comprehensive profit determination procedure for construction contract negotiations. However, that procedure was judged far too complex for general field use. During FY78, alternate procedures for each contract type -- construction, change orders, and A-E -- were developed; OCE approved the FY78 approach and concept. In March 1979, CERL published an interim report entitled, *Profit Primer: Evaluation of Alternate Profit Determination Models*, which summarized the issues to be considered and recommended a procedure for determining profit.[5] After reviewing *Profit Primer*, OCE requested that further refinements be made to the procedure recommended in that report.

Purpose

The objective of this study was to develop procedures for computing fair and reasonable profit objectives on Corps contracts.

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[1] *Engineer Contract Instructions*, ER 1180-1-1 (Office of the Chief of Engineers [OCE], 1 December 1969).

[2] *Negotiation Manual -- Uniform Standards for Employment and Payment of A-E Services*, EM 1110-345-30 (Department of the Army [DA], September 1952).

[3] *Architect-Engineer Contracting Procedures and Negotiations Guide FY79* (DA, OCE, Directorate of Military Construction, 1979).

[4] Army Procurement Procedure (APP) (Department of the Army).

[5] John M. Deponai III and R. I. Adiguzel, *Profit Primer: Evaluation of Alternate Profit Determination Models*, Interim Report P-99/ADA066112 (U.S. Army Construction Engineering Research Laboratory [CERL], March 1979).

* ASPR was retitled the Defense Acquisition Regulation (DAR) in March 1978.

Approach

A revised version (Proposal H) of the profit determination model recommended in *Profit Primer* was presented to several OCE field offices for review and comment. Proposal H was then revised based on the feedback from this review, and three new profit procedures (Proposals I, J, and K) were submitted to the field for criticism. In addition, these proposals were tested in three districts for a period of 1 month. Finally, recommended procedures were developed after analysis of the field comments, test results, and industry statistics.

Mode of Technology Transfer

The final profit procedure will be implemented as changes to the *Engineer Contract Instructions* if the decision is made to adopt this procedure.

2 INTERMEDIATE PROFIT PROPOSAL H

The basic concept of all proposals described in this report is that a contractor should be rewarded for participating in a project in proportion to the amount of his* investment in the project and to the degree of risk the investment entails. The focus of the proposals is the asset side of the contractor's balance sheet. Specifically, a contractor invests basically two types of assets in a project: current assets (funds) and fixed assets (e.g., facilities, equipment). The amount of current asset investment required for a project is a function of project characteristics and of contractual arrangements. The current asset investment required for a project is essentially independent of the level of contractor-owned, fixed asset investment in the project.

Proposal H

In the CERL *Profit Primer*, six profit determination models were evaluated. Based on feedback from OCE's review of that report, CERL developed Proposal H, which is described in Appendix A.

Comparison of Proposal H With the 1979 ECI Method

Essentially, Proposal H consists of evaluating the relative contribution of eight profit factors to the total project objective. Proposal H is generally similar in its approach to the 1979 ECI and AECPNG methods described in ECI and in the *A-E Contracting Procedures and Negotiations Guide, FY79*. However, there are some major differences between Proposal H and the 1979 ECI and AECPNG procedures (Figure 1). The profit factor rates used in Proposal H are related to a different base than those used in the 1979 ECI and AECPNG procedures, and the profit factor's weight range (0 to 1.0) for Proposal H addresses the entire range of the rate allocated to each profit factor. In Proposal H, the amount of "minimum" profit is addressed as a separate issue by the factor Variable Minimum Return. In the current ECI and AECPNG methods, this "minimum" profit is provided as a function of the minimum factor weight allowed; i.e., 0.03 for construction contracts and 0.07 for A-E contracts.

The profit factors used in Proposal H are also different from those in the ECI and AECPNG procedures. Only the factor Relative Difficulty of Work remains essentially unchanged. The 1979 factor, Subcontracting, is replaced by the factor Degree of Contractor Effort, which is keyed to the amount of work the contractor does versus the amount he does not do. The 1979 factor Degree of Risk is replaced by two factors, one to consider contractual risks (Type and Terms of Contract) and one to consider performance-related risks (Management Risks). The factor Period of Performance is replaced by the factor Duration of Project. The basis for computing duration is significantly different between the two methods. The factor Contractor's Investment in the current ECI and AECPNG procedures is replaced by the Proposal H factor Fixed Asset Investment. The profit allowed by the Fixed Asset Investment factor is intended to be roughly equivalent to the Defense Acquisition Regulation (DAR) Cost of Facilities Capital *plus* the equivalent of the DAR Profit Allowance for Facilities Investment. In the case of certain negotiated contracts and change orders, Proposal H also provides for a small "add-on" profit, the amount of which is determined by considering the applicability of four special factors to a particular contract situation. Two factors in the 1979 ECI and AECPNG methods -- Size of Job and Assistance by Government -- are deleted from Proposal H.

* The masculine pronoun is used throughout this report to refer to both genders.

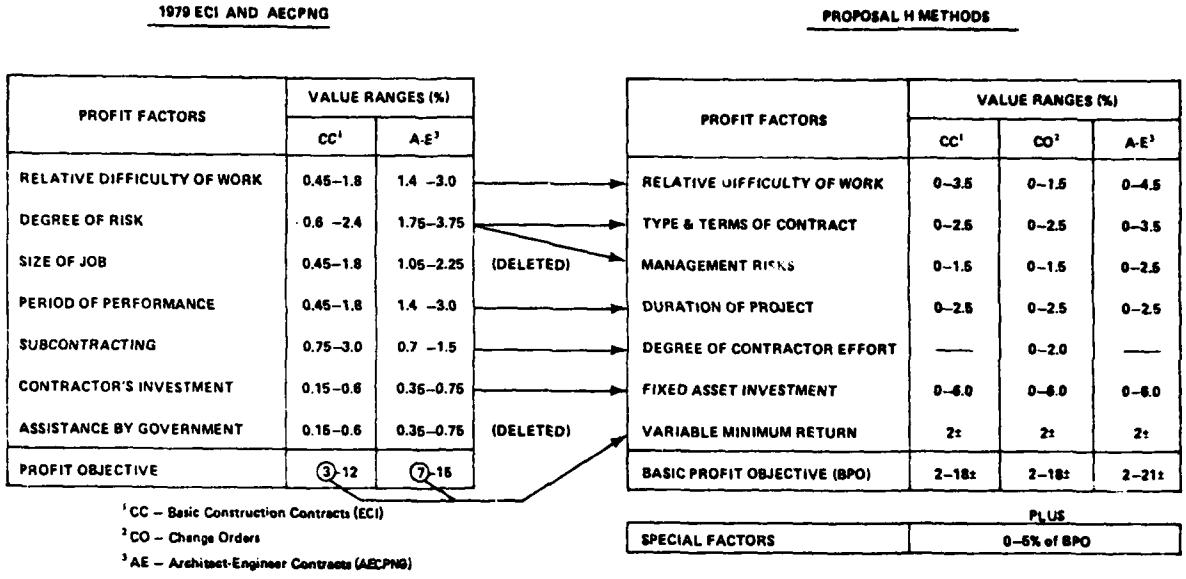


Figure 1. Comparison of 1979 ECI and AECPNG methods and Proposal H methods.

Field Criticism of Proposal H

In March 1979, a letter was sent to selected district and division offices soliciting criticism of Proposal H. Appendix B summarizes the comments received in response to that request. The most significant criticism advanced by the A-E community within the Corps was that Proposal H attempts unsuccessfully to force A-E contractual concerns into a construction contract mold. Some Corps construction personnel also strongly recommended providing an incentive for early settlements on change orders. Most Corps personnel responding felt that Special Factors should not be considered since such factors would be difficult to assess and to apply fairly.

3 INTERMEDIATE PROFIT PROPOSAL I FOR USE ON CORPS CONSTRUCTION CONTRACTS

In response to the comments received from the field on Proposal H, Proposals I, J, and K were developed. Proposal I, addressing profit on construction contracts, is described in Appendix C and discussed in this chapter. Proposals J and K address profit on A-E contracts and are discussed in Chapter 4.

Comparison of Proposal I With Proposal H

Proposal I provides up to 8 percent incentive to the contractor to settle change orders before the fact. The incentive to settle before the fact is only about 3/4 percent in Proposal H.

Whereas in Proposal H the rates assigned to Relative Difficulty of Work are different for basic contracts and for change orders (3.5 percent versus 1.5 percent), in Proposal I the rates are equal (2 percent), as shown in Figure 2. The factor Contractor Participation in Proposal I is considered for both basic contracts and change orders; in Proposal H, it was considered only for change orders under the equivalent Degree of Contractor Effort factor. The rates are greater in Proposal I for Type of Contract and Management Risks. However, the rates in Proposal I for Duration of Project and Fixed Asset Investment are less than in Proposal H, and Special Factors are eliminated as a profit consideration. Figure 2 indicates that when Proposal H is used, a maximum profit of 18± percent is possible. In Proposal I, this ceiling rate is reduced to 16± percent for basic contracts, to 19± percent for before-the-fact change order settlements, and to 13± percent for after-the-fact change order settlements.

Comparison of Proposal I With the 1979 ECI Method

As illustrated in Figure 3, Proposal I is generally similiar in its approach to the Corps 1979 method described in ECI. However, there are some major differences between Proposal I and the ECI procedure. The profit factor rates used in Proposal I are related to a different base than those used in the 1979 ECI procedure, and the profit factor weight range (0 to 1.0) for Proposal I addresses the entire range of the rate allocated to each profit factor. In Proposal I, the amount of "minimum" profit is addressed as a separate issue by the factor Risk-Free Return. In the 1979 ECI method, the "minimum" profit is provided as a function of the minimum factor weight allowed -- i.e., 0.03 for construction contracts.

The profit factors used in Proposal I are also different from those in the 1979 ECI procedure. Only the factor Relative Difficulty of Work remains essentially unchanged. The factor Subcontracting is replaced by Contractor Participation, which is keyed to how much of the work the contractor does versus how much he does not do. The factor Degree of Risk is replaced by two factors, one to consider contractual risks (Type of Contract) and one to consider performance-related risks (Management Risks). The factor Period of Performance is replaced by Duration of Project. Two factors in the 1979 ECI procedure -- Size of Job and Assistance by Government -- are eliminated in Proposal I. Fixed Asset Investment replaces the Contractor's Investment factor and is also intended to include indirectly a consideration for Cost of Facility Capital. Proposal I, like the other proposals, focuses on the assets side of the ledger, and asks the question, "How much incentive must be offered to induce a contractor to undertake risks?"

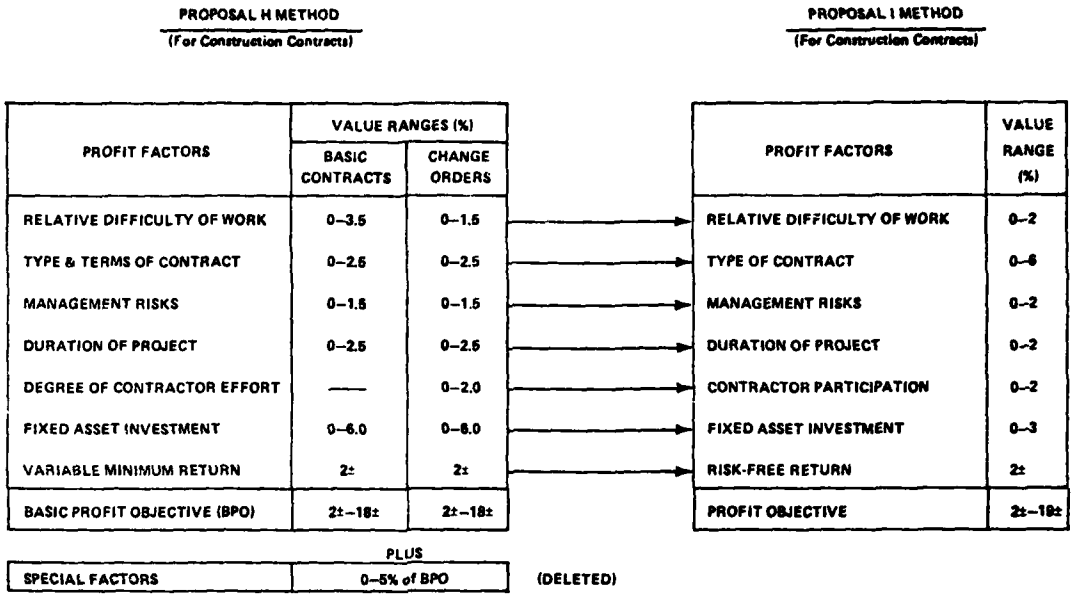


Figure 2. Comparison of Proposal H method for construction contracts and Proposal I method.

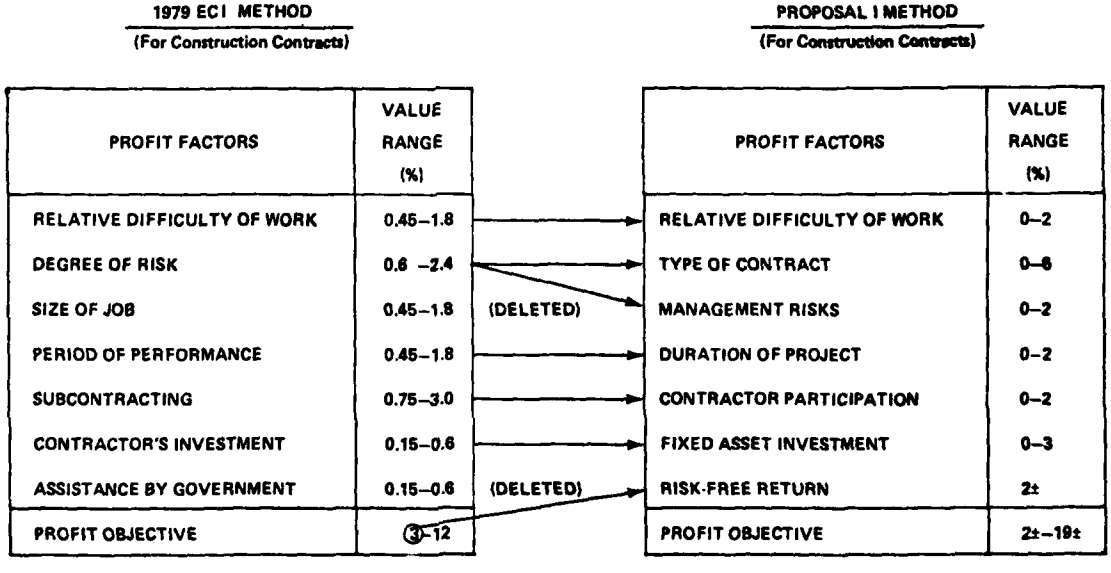


Figure 3. Comparison of 1979 ECI method for construction contracts and Proposal I method.

Field Criticism of Proposal I

On 21 June 1979, a letter was sent to selected individuals in the construction branches at Corps field offices and at OCE to solicit their criticism of Proposal I. The comments received in response to that request are summarized in Appendix D. The comments revealed that there were still some misconceptions about the purpose of the Risk-Free Return factor. Some individuals confused this with the payment of interest. One constructive comment was to use as the basis for the Risk-Free Return factor the interest rates established semiannually by the Secretary of the Treasury (under PL 92-41, Renegotiation Act of 1951) -- rather than the Treasury Bill rates.

Another issue of major importance was whether a Size of Job factor should be considered. Some persons argued that small contracts should receive a higher profit percentage than large ones since it is easier to overrun costs on projects of small monetary value. However, such a consideration pertains to contingency allowance, a cost consideration, and not to profit.

4 INTERMEDIATE PROFIT PROPOSALS J AND K FOR USE ON CORPS A-E CONTRACTS

Comparison of Proposals J and K With Proposal H

As explained in Chapter 3, Proposals J and K -- described in Appendices E and F -- were developed for use on A-E contracts. Figure 4 compares Proposal H and Proposal J. Proposal K is essentially a graphical short form of Proposal J, designed to be used only on contracts under $100,000, or on those contracts with no significant fixed asset investment. There is no graphical equivalent in Proposal H to which Proposal K can be compared.

There are several major differences between Proposals H and J. Contractor Participation is an additional factor in Proposal J that is not considered in Proposal H for A-E contracts, and Proposal J does not include the Special Factors of Proposal H. Management Risk considerations of Proposal H are included as part of the Relative Difficulty factor in Proposal J, and the combined significance of these concerns is reduced. The Fixed Asset Investment rate for Proposal J is greatly reduced -- from 6 percent to 1 percent. The Proposal J rate for Duration of Project is less than that of Proposal H. However, the time consideration under Duration of Project is reduced from 24 months in Proposal H to 12 months in Proposal J. The algorithms for Relative Difficulty and Fixed Asset Investment are changed to provide more clarity and direction. To reduce confusion as to its purpose, the Proposal H factor Variable Minimum Return is renamed Risk-Free Return in Proposal J. Proposal H allows a ceiling markup of 21± percent. Proposal J allows only a 14± percent ceiling markup. The maximum markup allowable in Proposal K is 13 percent for firm fixed-price contracts and 10 percent for cost-plus contracts.

Comparison of Proposal J With the 1979 AECPNG Method

Proposal J is generally similar in its approach to the 1979 Corps method described in *A-E Contracting Procedures and Negotiations Guide, FY79.* However, there are some major differences between Proposal J and the AECPNG procedure (Figure 5). The profit-factor rates used in Proposal J are related to a different base than those used in the 1979 AECPNG procedure, and the profit-factor weight range (0 to 1.0) for Proposal J addresses the entire range of the rates allocated to each profit factor. In Proposal J, the amount of "minimum" profit is addressed as a separate issue by the factor Risk-Free Return. In the 1979 AECPNG method, the "minimum" profit is provided as a function of the minimum factor weight allowed -- i.e., 0.07 for A-E contracts.

The profit factors used in Proposal J are also different from those in the 1979 AECPNG procedure. The factor Relative Difficulty of Work is expanded to address concepts such as the impact of crashing the schedule and control problems. The 1979 factor Subcontracting is replaced by the Proposal J factor Contractor Participation, which is keyed to the amount of the work the contractor does versus the amount he does not do. The 1979 factor Degree of Risk is replaced by two factors, one to consider contractual risks (Type of Contract), and one to consider performance-related risks (Relative Difficulty of Work). The 1979 factor Period of Performance is replaced by the factor Duration of Project. The two 1979 factors, Size of Job and Assistance by Government, are eliminated. The 1979 factor Contractor's Investment is replaced by the Fixed Asset Investment factor, which indirectly includes consideration for Cost of Facilities Capital. The focus of Proposal J is on providing contractors enough incentive to assume risk, not on reimbursing their costs.

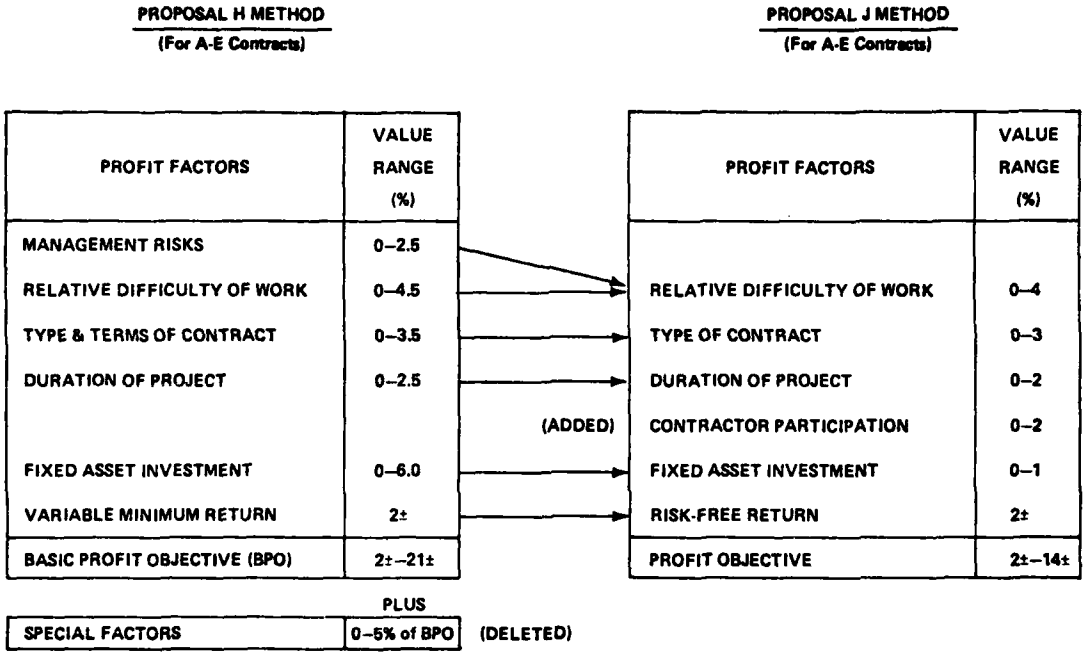


Figure 4. Comparison of Proposal H method for A-E contracts and Proposal J method.

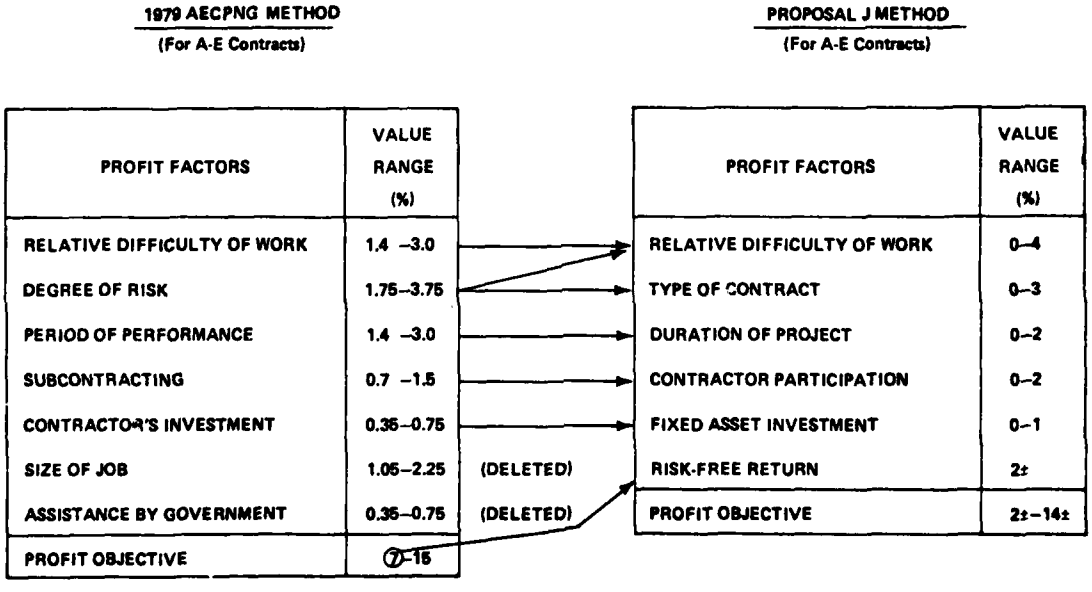


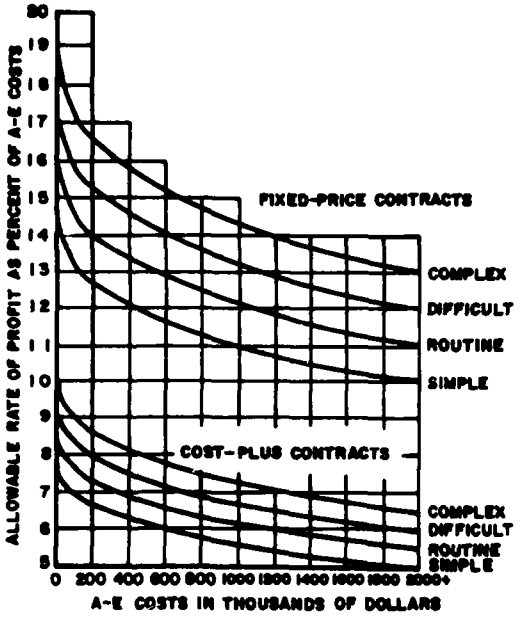
Figure 5. Comparison of 1979 AECPNG method for A-E contracts and Proposal J method.

Comparison of Proposal K With the EM 1110-345-30 Method

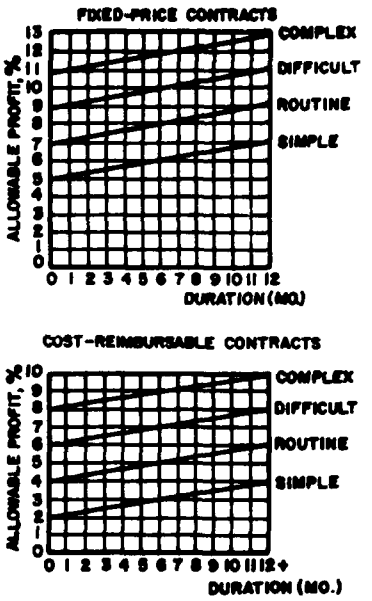
Proposal K is significantly different from one Corps method used during 1979 and described in EM 1110-345-30. First, the allowable profit limits are different (Figure 6). With the procedure described in EM 1110-345-30, the allowable profit limits are 10 percent to 19.5 percent for fixed-price contracts and 5 percent to 10 percent for cost-plus contracts. In Proposal K, the allowable profit limits are 5 percent to 13 percent for fixed-price contracts and 2 percent to 10 percent for cost-plus contracts. The factor Size of Job is not considered in Proposal K. However, in both methods, the same categories (simple, routine, difficult, and complex) are used to describe the relative difficulty of work.

Field Criticism of Proposals J and K

On 21 June 1979, a letter was sent to selected individuals in the A-E branches at the Corps field offices and at OCE requesting their criticism of Proposals J and K. A summary of these comments is in Appendix G. Most field personnel believe that Proposals J and K yield too low a profit. The comments also indicate that the factor Fixed Asset Investment is unnecessary because the level of fixed assets required for A-E work is not a meaningful discriminator of the level of risks.



EM 1110-345-30 Method
(For A-E Contracts)



Proposal K Method
(For A-E Contracts)

% Range for Fixed-Price (FP) Contracts

10%-19 1/2%	5%-13%

% Range for Cost-Plus (CP) Contracts

5%-10%	2%-10%

Size of Job Influence

6 1/2% (FP Contracts) 3 1/2% (CP Contracts)	None

Duration of Work Influence

None	2% per year

Difficulty of Work Influence

4 1/2% (FP Contracts) 2 1/2% (CP Contracts)	6% (All Contract Types)

Figure 6. Comparison of EM 1110-345-30 method for A-E contracts and Proposal K method.

5 FINAL RECOMMENDATIONS FOR PROFIT DETERMINATION PROCEDURES ON CORPS CONTRACTS

The profit procedures recommended for use on Corps contracts are presented in Appendix H as recommended changes to the ECI. Proposed ENG Forms XXXXa, b, and c in Appendix I summarize these recommendations. The final methods of computing profit were developed after considering the field criticism, the results of testing Proposals I, J, and K, and the implications of certain industry statistics collected by Robert Morris Associates (RMA) for 1976 and 1977.

Calibration Rationale

The following summarizes the calibration rationale for the recommended profit procedures. A more detailed discussion is presented in Appendix J. Note that this specific rationale was *not* used to calibrate Proposals H through K.

The recommended profit procedures are based on the concept that Return on Investment (ROI) is a product of Profit Margin (PM) and Turnover (TO):

$$ROI = PM \times TO$$

or,

$$\frac{Profit}{Assets} = \frac{Profit}{Volume} \times \frac{Volume}{Assets}$$

Contractors who face the same amount of risk should receive the same rate of return on their investment. RMA business statistics for some construction and A-E firms for the years 1976 and 1977 were examined to decide a reasonable profit margin for "average" firms. Based on the RMA data, CERL determined that for the Corps' contracting environment a turnover of 2.5 is representative of the "average" construction firm, and a turnover of 2.0 is representative of an "average" A-E firm. An annual target "ceiling rate" of 30 percent is assumed as an appropriate ROI for the most risky construction and A-E jobs. Dividing this ROI rate by the "average" representative turnover yields the markup ceiling. For A-E firms, the markup ceiling is 30/2.0 = 15 percent. For the construction industry, the markup ceiling is 30/2.5 = 12 percent. As explained in Appendix J, an additional 3 percent is allotted to the construction contract markup ceiling to compensate for higher than average Fixed Asset Investment levels. These ceiling markup rates are then distributed consistently across the appropriate profit factors to be considered for construction contracts or for A-E contracts.

Recommended Profit Determination Procedure for Construction Contracts

The differences between the profit factor rates of Proposal I and the recommended method are listed in Figure 7 and summarized here:

1. In the recommended method, the Management Risk concerns of Proposal I are assigned to the Relative Difficulty of Work factor, and the significance of this factor is slightly reduced.

2. The format of the recommended method differs somewhat from that of Proposal I (Figure C1 versus ENG Form XXXXa, Appendix I).

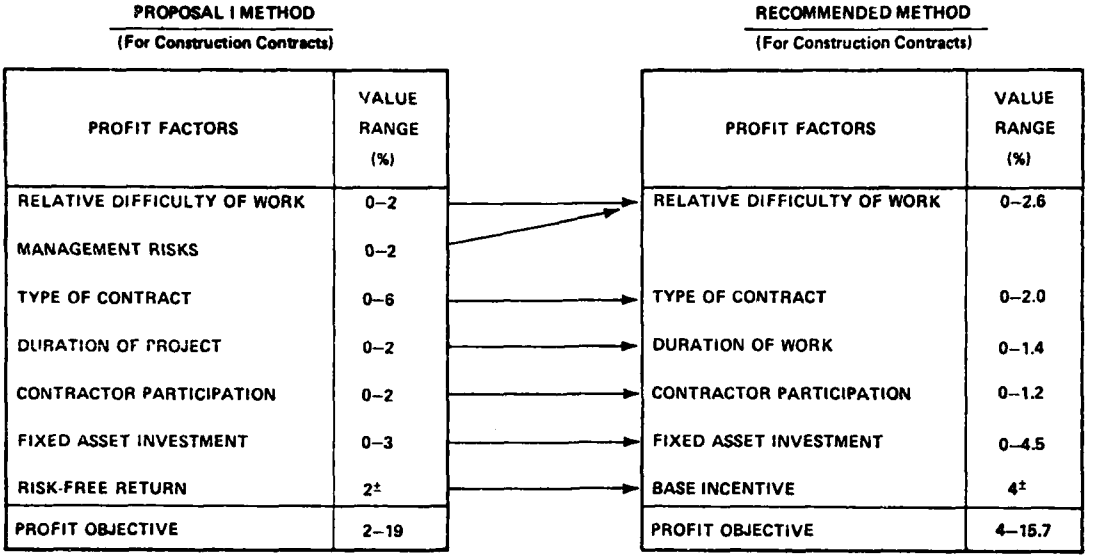


Figure 7. Comparison of Proposal I method and recommended method for construction contracts.

3. The recommended method provides rates for before-the-fact and after-the-fact settlements, but does not distinguish between basic contracts and change orders as does Proposal I. The differential incentive between before-the-fact and after-the-fact settlements is reduced from 8 percent to 3.3 percent.

4. In Proposal I, the weights for various contract types vary within certain ranges. In the recommended method, the weights are fixed by contract type, and the significance of the Type of Contract factor is greatly reduced.

5. The name of the Risk-Free Return factor is changed to Base Incentive to better describe its purpose, and the weight assigned to it is doubled in consideration of the rationale used to calibrate the model.

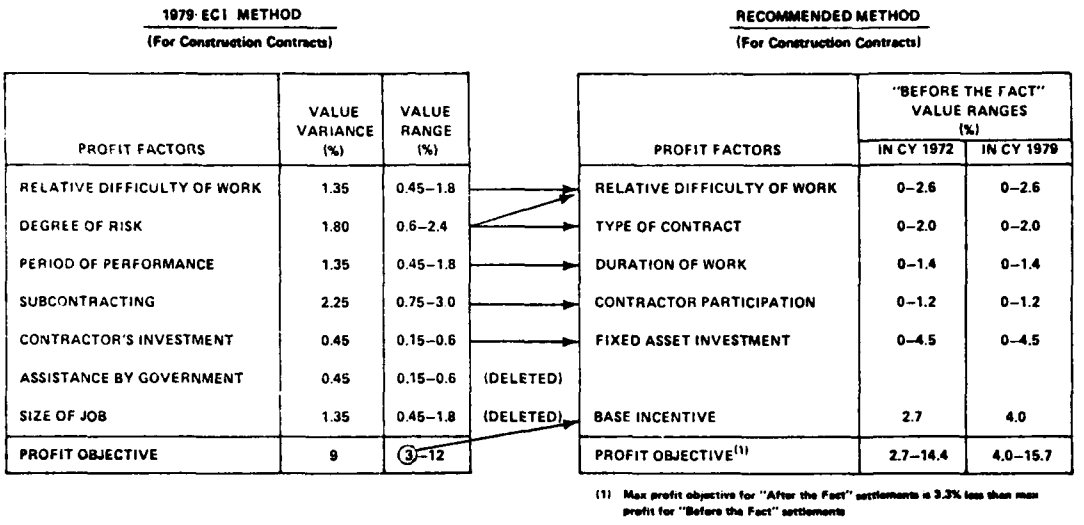
6. The significance of the Fixed Asset Investment factor is also increased.

Comparison of Recommended Method With the 1979 ECI Method

A comparison of the recommended method for construction contracts and the 1979 ECI method is shown in Figure 8. The most significant difference is that in the recommended method, the amount of investment of contractor-owned fixed assets in a project has 10 times the importance assigned in the 1979 ECI method. The overall value ranges possible are slightly higher than in the 1979 ECI method, and two factors -- Size of Job and Assistance by Government -- are deleted.

Comparison of Test Results of Proposal I With Results of Recommended Method

Proposal I was tested in two Corps of Engineers districts in 1979 to determine the reasonableness of the profit objective derived from its use. Participants in the test were asked to apply Proposal I to all contracts which they received during a 1-month period. In addition, they were asked to evaluate the reasonableness of the resulting profit objective. If Proposal I did not



1979 ECI METHOD
(For Construction Contracts)

PROFIT FACTORS	VALUE VARIANCE (%)	VALUE RANGE (%)	
RELATIVE DIFFICULTY OF WORK	1.35	0.45–1.8	
DEGREE OF RISK	1.80	0.6–2.4	
PERIOD OF PERFORMANCE	1.35	0.45–1.8	
SUBCONTRACTING	2.25	0.75–3.0	
CONTRACTOR'S INVESTMENT	0.45	0.15–0.6	
ASSISTANCE BY GOVERNMENT	0.45	0.15–0.6	(DELETED)
SIZE OF JOB	1.35	0.45–1.8	(DELETED)
PROFIT OBJECTIVE	9	③–12	

RECOMMENDED METHOD
(For Construction Contracts)

PROFIT FACTORS	"BEFORE THE FACT" VALUE RANGES (%) IN CY 1972	IN CY 1979
RELATIVE DIFFICULTY OF WORK	0–2.6	0–2.6
TYPE OF CONTRACT	0–2.0	0–2.0
DURATION OF WORK	0–1.4	0–1.4
CONTRACTOR PARTICIPATION	0–1.2	0–1.2
FIXED ASSET INVESTMENT	0–4.5	0–4.5
BASE INCENTIVE	2.7	4.0
PROFIT OBJECTIVE[1]	2.7–14.4	4.0–15.7

(1) Max profit objective for "After the Fact" settlements is 3.3% less than max profit for "Before the Fact" settlements

Figure 8. Comparison of 1979 ECI method for construction contracts and recommended method.

yield a profit percentage in what the raters termed an acceptable range, they were to identify their idea of a reasonable profit objective. After analyzing the results of this test, CERL applied the recommended profit procedure to the test contracts to determine if the profit percentages generated using the recommended method were more consistent with what the raters felt was a reasonable profit. The results are explained in Appendix K.

Briefly, Proposal I yields an overall average profit objective of 9.9 percent. The overall average of "reasonable" profit objectives is 8.8 percent. Some of the difference is attributed to user error. In some cases certain factors, such as Fixed Asset Investment and Duration of Work, were obviously misinterpreted by the raters during the test. When CERL applied the recommended profit method to the test contracts, such obvious errors were corrected. Certain other minor adjustments were also made, as described in Appendix K. Applying the recommended profit procedure results in an average profit of 8.6 percent for the test contracts. Therefore, the recommended method provides results that are generally consistent with what some field personnel believe to be reasonable. Note, however, that the test sample is not unbiased.

Recommended Profit Determination Procedure for A-E Contracts

There are two recommended procedures for determining profit on A-E contracts: one is based on a graphical short form developed from Proposal K and designed to be used on contracts under $100,000; the other was developed from Proposal J. The profit rates for Proposal J and those for the recommended method are compared in Figure 9. Figure 10 compares the rates of Proposal K with the recommended graphical method for A-E contracts.

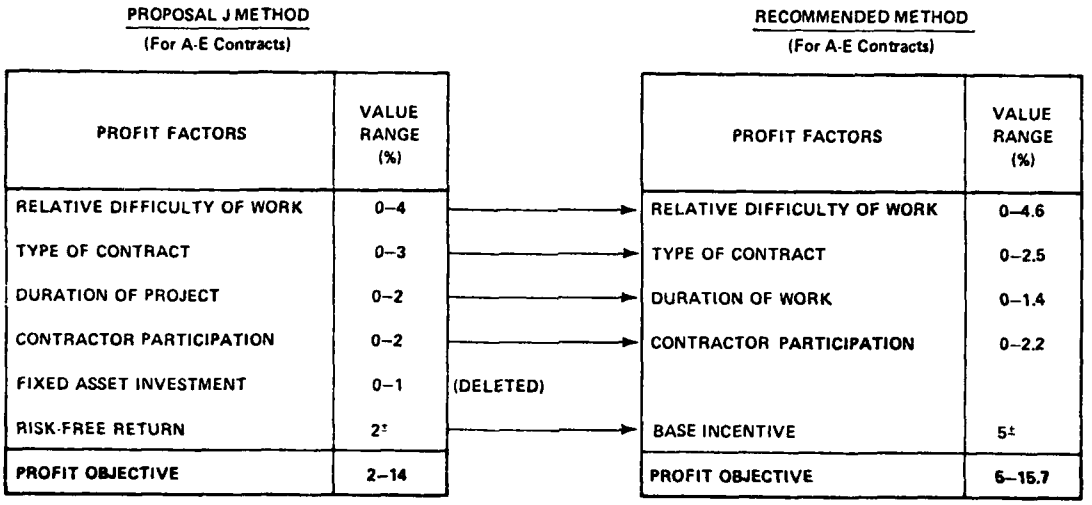
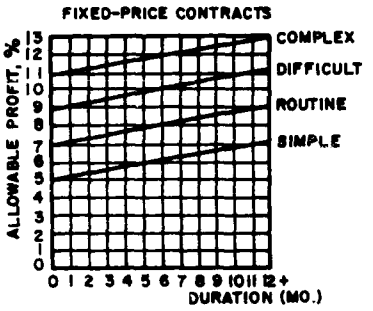


Figure 9. Comparison of Proposal J method and recommended method for A-E contracts.

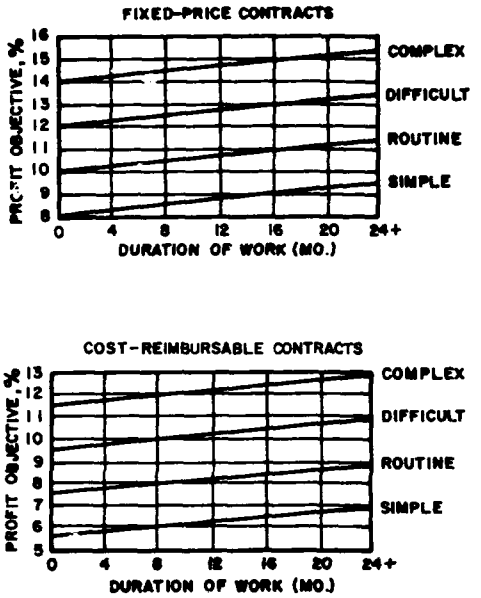
The most significant difference between Proposal J and the recommended method for A-E contracts is that there is no Fixed Asset factor in the recommended method. The factor Risk-Free Return is renamed Base Incentive to better describe its purpose; the fixed weight assigned to the Base Incentive function is 2-1/2 times that of Proposal J. The guidelines for evaluating Relative Difficulty of Work are greatly improved; the examples under this section of ENG Form XXXXb (Appendix I) are also revised to be more current and more indicative of the Corps' mission today. The Type of Contract factor is modified as follows: previously, a weight was assigned within ranges allotted to the different types of contracts; in the recommended method, a single, fixed weight for each type of contract is designated as an appropriate measure of risk. The Duration of Work factor is expanded to address durations up to 24 months; under Proposals J and K, the maximum was 12 months. Both methods recommended for A-E contracts yield higher profit objectives than Proposals J and K.

Comparisons of Recommended Methods With Two Corps Methods

Comparisons of the recommended methods and the two Corps methods used in 1979 are shown in Figures 11 and 12. The most significant difference is that the importance of Relative Difficulty of Work is increased by a factor of almost 3 over the 1979 AECPNG method, whereas the significance of the "Base Incentive" function is 30 percent to 50 percent less than provided by the equivalent factor in the 1979 AECPNG method. The recommended graphical procedure is completely different from the EM 1110-345-30 graphical method.



Proposal K Method
(For A-E Contracts)



Recommended Graphical Method
(For A-E Contracts)

% Range for Fixed-Price Contracts

5%-13%	8%-15 1/2%

% Range for Cost-Reimbursable Contracts

2%-10%	5 1/2%-13%

Duration of Work Influence

2% per year (1 year max)	3/4% per year (2 year max)

Difficulty of Work Influence

6%	6%

Figure 10. Comparison of Proposal K and recommended graphical method for A-E contracts.

1979 AECPNG METHOD
(For A-E Contracts)

PROFIT FACTORS	VALUE VARIANCE (%)	VALUE RANGE (%)	
RELATIVE DIFFICULTY OF WORK	1.6	1.4–3.0	
DEGREE OF RISK	2.0	1.75–3.75	
PERIOD OF PERFORMANCE	1.6	1.4–3.0	
SUBCONTRACTING	0.8	0.7–1.5	
CONTRACTOR'S INVESTMENT	0.4	0.35–0.75	(DELETED)
SIZE OF JOB	1.2	1.05–2.25	(DELETED)
ASSISTANCE BY GOVERNMENT	0.4	0.35–0.75	(DELETED)
PROFIT OBJECTIVE	8	7–15	

RECOMMENDED METHOD
(For A-E Contracts)

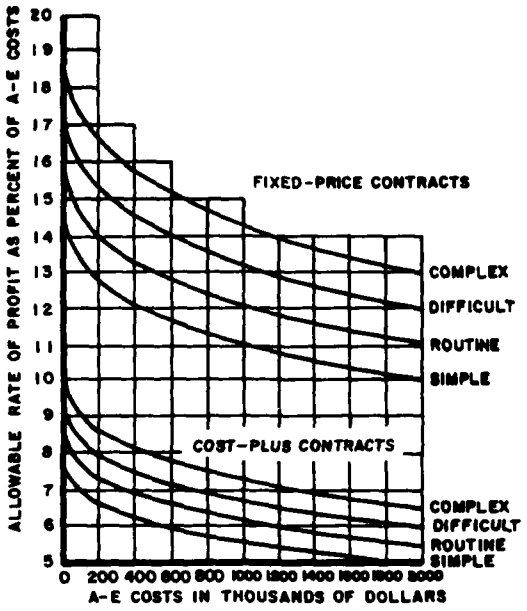
PROFIT FACTORS	VALUE RANGES (%) IN CY 1972	VALUE RANGES (%) IN CY 1979
RELATIVE DIFFICULTY OF WORK	0–4.6	0–4.6
TYPE OF CONTRACT	0–2.5	0–2.5
DURATION OF WORK	0–1.4	0–1.4
CONTRACTOR PARTICIPATION	0–2.2	0–2.2
BASE INCENTIVE	3.4	5.0
PROFIT OBJECTIVE	3.4–14.1	5.0–15.7

Figure 11. Comparison of 1979 AECPNG method for A-E contracts and recommended method.

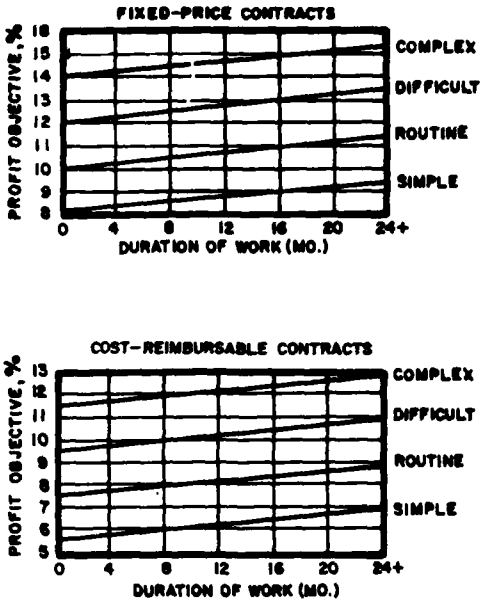
Comparison of Test Results for Proposals J and K With Results From Recommended Methods

Proposals J and K were tested in three districts in 1979 to determine their practical applicability as well as the reasonableness of the profit objective derived from their usage. Participants in the test were asked to apply Proposals J or K to all contracts submitted to their offices during a 1-month test period. In addition, they were asked to evaluate the "reasonableness" of the resulting profit objective. If the rater considered a profit percentage derived to be unacceptable, he was to identify a reasonable profit objective for that particular contract. CERL applied its recommended profit procedures to the test contracts to determine if the recommended methods yielded results that were more consistent with what the raters felt were reasonable profits. The test results are shown in Appendix L.

The overall average profit objective obtained by applying Proposal J is 10.1 percent. The overall average profit percentage considered reasonable by the users of this method is 12.2. Proposal K yields an average profit objective of 8.7 percent, compared to the average recommended reasonable objective of 12.9 percent. Applying the recommended method to the test contracts -- and adjusting for obvious errors made by the test raters -- raises the nongraphical procedure's average overall profit objective from 10.1 percent to 12.8 percent; 12.2 is considered reasonable. The recommended graphical method produces an overall average objective of 11.2 percent. Note that the test samples are not unbiased, and the sets of contracts evaluated for Proposals J and K are slightly different. Applying the nongraphical and graphical recommended procedures to the sample set of contracts yields profit objectives of 12.3 percent and 12.4 percent, respectively.



EM 1110-345-30 Method
(For A-E Contracts)



Recommended Graphical Method
(For A-E Contracts)

% Range for Fixed-Price (FP) Contracts

10%-19 1/2%	8%-15.5%

% Range for Cost-Reimbursable (CR) Contracts

5%-10%	5 1/2%-13%

Size of Job Influence

6 1/2% (FP Contracts) 3 1/2% (CR Contracts)	None

Duration of Work Influence

None	3/4% per year

Difficulty of Work Influence

4 1/2% (FP Contracts) 2 1/2% (CR Contracts)	6% (All Contract Types)

Figure 12. Comparison of EM 1110-345-30 Method for A-E contracts and recommended graphical method.

6 CONCLUSION AND RECOMMENDATION

The profit procedures described in Chapter 5 and Appendix H of this report will provide for fair and reasonable profits on Corps construction contracts, change orders, and A-E contracts.

It is recommended that the Corps adopt the profit procedures described in Appendix H as the official profit guidelines for use on construction and A-E contracts.

REFERENCES

Architect-Engineer Contracting Procedures and Negotiations Guide FY79 (Department of the Army [DA], Office of the Chief of Engineers [OCE], Directorate of Military Construction, 1979).

Army Procurement Procedure (APP) (Department of the Army).

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"Cost Accounting Standard -- Cost of Money as an Element of the Cost of Facilities Capital," *Code of Federal Regulations*, Vol 4, Part 414 (January 1, 1979).

Deponai, John M. III and R. I. Adiguzel, *Profit Primer: Evaluation of Alternate Profit Determination Models*, Interim Report P-99/ADA066112 (U.S. Army Construction Engineering Research Laboratory [CERL], March 1979).

Engineer Contract Instructions, ER 1180-1-1 (OCE, 1 December 1969).

Negotiation Manual -- Uniform Standards for Employment and Payment of A-E Services, EM 1110-345-30 (DA, September 1952).

Statement Studies (Robert Morris Associates, 1976, 1977).

Wood, Robert K., Myron G. Myers, and M. Brian McDonald, *A Uniform Profit Policy for Government Acquisition* (Logistics Management Institute, December 1978).

APPENDIX A:

WEIGHTING ALGORITHMS FOR PROPOSAL H

The following algorithms are guides for assigning profit-factor weights and are used with the Proposal H Profit Objective Determination Worksheet (Figure A1). The weights are multiplied by the appropriate rate schedule for A-E contracts, for change orders, or for construction contracts. The product of rate times weight gives a percent markup value attributable to that factor. The sum of all profit factor values is equal to the Basic Profit Objective (BPO). The BPO plus add-on profit (if applicable) yields the Profit Objective.

Relative Difficulty of Work

The work is weighted according to the amount of knowledge, skill, and experience required of the contractor or A-E firm (Figure A2). If the work is complex, a weight in the range of 0.75 to 1.0 is assigned. If the work is difficult, the range is 0.5 to 0.75; if routine, the range is 0.25 to 0.5. The simplest jobs, such as procurements of materials, are weighted in the range 0 to 0.25.

Degree of Contractor Effort

The job is weighted proportionally to the amount of work actually done by the contractor (Figure A3). Where the contractor does 20 percent or less of the work, the weight is 0.0. When all the work is performed by the prime contractor, the factor is weighted at 1.0. The factor is applicable to change orders only.

Type and Terms of Contract

When proper selection of contract type has been made, the profit factor weighting by contract type will usually be in the ranges listed in Table A1. Within the ranges of Table A1, the work is weighted according to criteria such as the completeness and clarity of the technical specifications, and the timing of contract negotiations (whether before or after the fact).

Management Risks

When the job entails essentially no performance risk, the factor should be weighted at 0.0. Jobs with the highest level of performance risk are weighted at 1.0, those of average risk at 0.5. Appropriate intermediate values are assigned to other jobs. This is one of the most difficult factors to evaluate. Considerations should include the quantity and diversity of principal work tasks required to do the job, the labor intensity of the job, special control problems, "crashing" requirements, whether negotiation is before or after the fact, and the accuracy of planning forecasts.

Duration of Project

Jobs requiring 24 months or more are weighted a maximum of 1.0; shorter jobs are weighted proportionately less (Figure A4). The duration to be used is the estimated total time required for contract performance. For change orders, the duration to be used is the most current estimate of total job duration including any change in duration due to the change order. The "duration profit" computed for a change order should be based on the same criterion -- i.e.,

☐ CC ☐ CO ☐ AE	PROFIT OBJECTIVE DETERMINATION WORKSHEET				
FACTOR	RATE (%)			WEIGHT (0–1.0)	VALUE %
	CC	CO	AE		
1. RELATIVE DIFFICULTY OF WORK	3.5	1.5	4.5		
2. DEGREE OF CONTRACTOR EFFORT	—	2.0	—		
3. TYPE & TERMS OF CONTRACT	2.5	2.5	3.5		
4. MANAGEMENT RISKS	1.5	1.5	2.5		
5. DURATION OF PROJECT	2.5	2.5	2.5		
6. FIXED ASSET INVESTMENT	6.0	6.0	6.0		
7. VARIABLE MINIMUM RETURN	TREASURY BILL RATE: _____			0.2	
BASIC PROFIT OBJECTIVE					
8. SPECIAL FACTORS	_____ % OF B.P.O.				
PROFIT OBJECTIVE					

Figure A1. Proposal H Profit Objective Determination Worksheet.

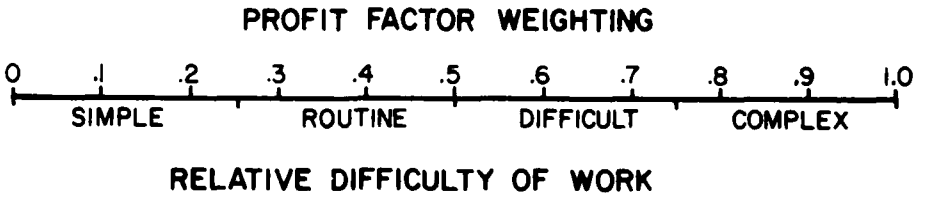


Figure A2. Proposal H factor weighting scale for Relative Difficulty of Work.

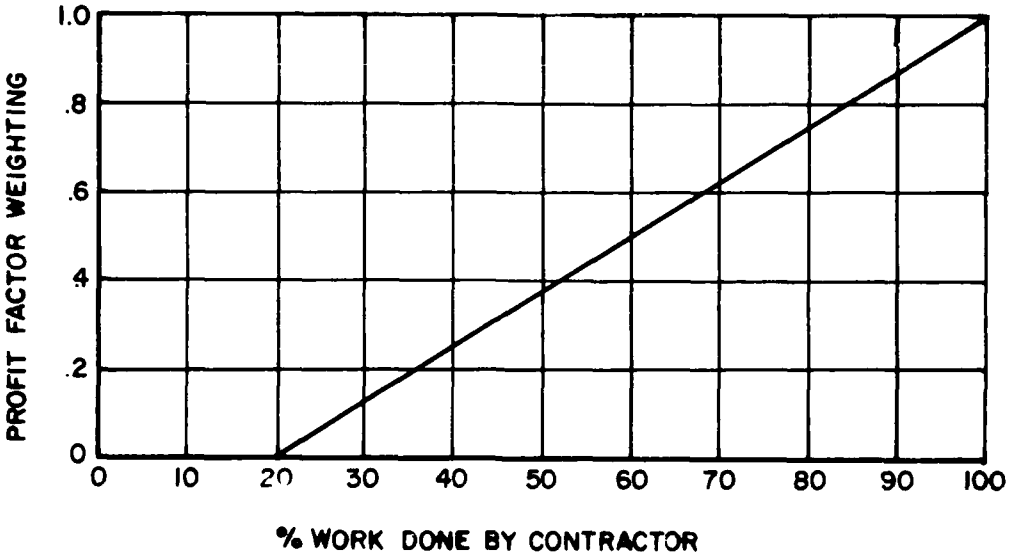


Figure A3. Proposal H factor weighting graph for Degree of Contractor Effort.

Table A1

Proposal H Factor Weights by Contract Types

Type of Contract	Weight Ranges
Cost Plus Fixed Fee	0.0 - 0.2
Cost Plus Incentive Fee	0.2 - 0.5
Fixed Price Incentive	0.5 - 0.7
Firm Fixed Price	0.7 - 1.0

total project duration -- as the "duration profit" that would be computed if one had the advantage of knowing exactly when the job would end.

Fixed Asset Investment

This factor is weighted according to the relative amount of the total contract cost that is attributable to reimbursement for use of contractor-owned plant, equipment, computers, etc. However, the contractor's fixed asset investments in land and in office buildings are not considered. The intent is that allowable contract costs attributable to such overhead fixed asset investments be reimbursed but not rewarded. The factor weighting is also dependent on the degree of investment risk that the contractor has in the fixed assets actually used on the job.

The following definitions apply when Figure A5 is used. A job with a high level of fixed asset investment is defined as one in which equipment, plant, or computer costs are 30 percent or more of the contract cost. A medium investment level is one in which such fixed asset costs are about 20 percent of the total contract costs, and a low investment level about 10 percent of the total costs. On a scale of 1 to 10, a fixed asset has an investment risk index of 10 if it is a special purpose asset with extremely limited market demand or if it has an estimated payback period of 10 years or more, an investment risk index of 5 if there is a normal market demand

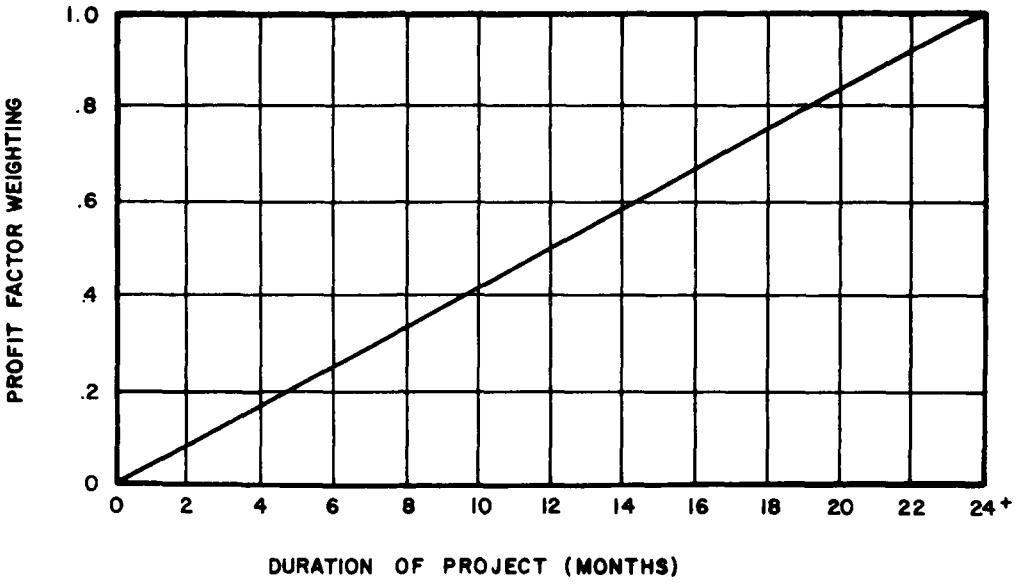


Figure A4. Proposal H factor weighting graph for Duration of Project.

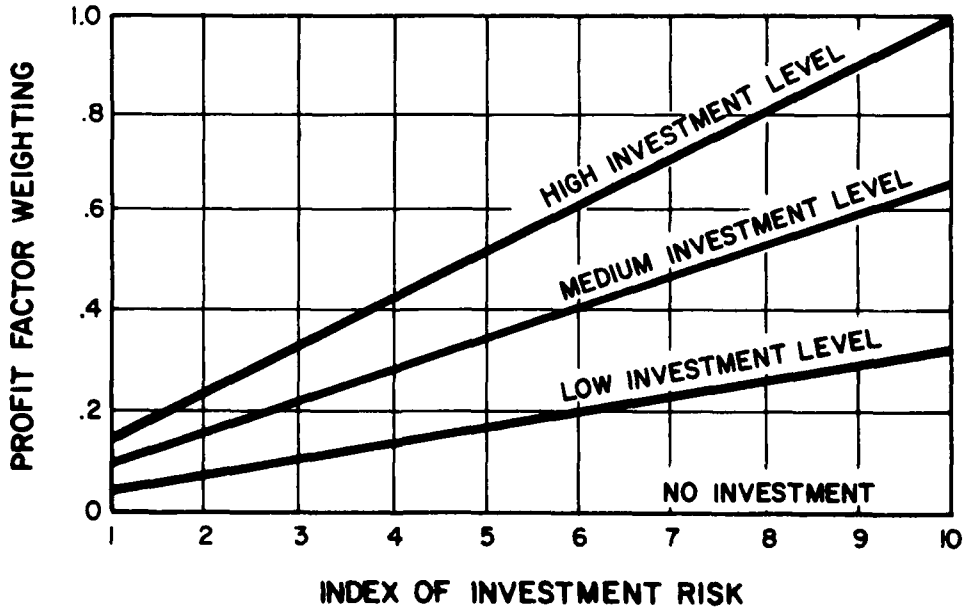


Figure A5. Proposal H factor weighting graph for Fixed Asset Investment.

for it or if it has an estimated payback period of about 5 years, and an investment risk index of 1 if there is a very high market demand for it or if it has an estimated payback period of 1 year or less. Intermediate risk index values represent gradations between these index benchmarks. For a particular job, a risk index is selected which is most representative of the "average" risk characteristics of the contractor's fixed assets used on the job.

Variable Minimum Return

A fixed weight of 0.2 is applied to the current Treasury Bill rate for bills of duration similar to the estimated project duration. The 12-month rate is used for projects longer than 1 year. Whereas all other factors provide a "premium for risk," this factor is intended to provide a "risk free" return to the contractor. The factor reflects the influence of alternate investment opportunities available to contractors. The interest rates on U.S. Treasury Bills are used as the basis since they are generally accepted as being a risk-free investment, and the rates are updated frequently and are responsive to prevailing market conditions.

Special Factors

Add-on profit is allowed for special factors in negotiated contracts and in change orders only if they are applicable to the contractor. In Table A2, the factor Quality and Productivity of Job is applicable only to change orders and is worth up to 5 percent of the BPO. It is used to reward contractors for work of above-average quality and for above-average productivity in the performance of an on-going job. A reward of up to 2 percent of the BPO is allowed for those contractors who actively support small businesses and minority businesses in their subcontracting programs, and a reward of up to 2 percent of the BPO is allowed for those contractors who actively support the Government's labor surplus area program. Finally, up to 1 percent of the BPO is considered in change orders only for those contractors who have demonstrated extraordinary initiative to conserve energy.

Table A2

Proposal H Factor Weights for Special Factors

Special Factor	Weight Range
*Quality and Productivity of Job	0 to 5% of BPO
Small and Surplus Area Participation	0 to 2% of BPO
Labor Surplus Area Participation	0 to 2% of BPO
*Energy Conservation	0 to 1% of BPO

*For use on Change Orders only

APPENDIX B:

SUMMARY OF COMMENTS ON PROPOSAL H

This appendix is a summary of comments about Proposal H received from district and division offices in response to a CERL Facility Systems Division (FS) letter dated 16 March 1979, subject: Proposed Profit Determination Procedure for Use on Corps Contracts. The responses are classified as issues with which CERL either agrees or disagrees.

Views With Which CERL Agrees

1. Issue: Separation of A-E and Construction. A-E contracts do not fit well into procedures designed for use on construction contracts. Unique profit methods should be developed to address separately the needs of A-E and construction contracts.

2. Issue: Incentive to Settle Before the Fact. Significant incentive should be provided to encourage early settlement in the case of change orders. Those contracts negotiated after the fact should be penalized by a loss of profit opportunity.

3. Issue: Relative Difficulty of Work. There should be no rate differential between basic construction contracts and change orders.

4. Issue: Degree of Contractor Effort. This factor should be expanded to include basic contracts as well as change orders. In most situations a good estimator will be able to predict closely enough how much of the work will be subcontracted.

5. Issue: Fixed Asset Investment.

a. A-E-related comment: a 6 percent rate for this factor is too high for A-E work.

b. Construction-related comment: the rate for this factor is too high because (1) some Corps manuals still include a Cost of Facilities Capital allowance, and (2) duplication of reimbursement may occur on change order work.

CERL comment: CERL agrees that the rate should be lowered. However, the new algorithm (for Proposal I) provides that assets including a Cost of Facilities Capital allowance should not be rewarded by this factor. Also, only those assets required for change-order work are rewarded. Unnecessary duplication should not occur.

6. Issue: Special Factors. These factors should be deleted since they would be very difficult to assess and to apply fairly.

7. Issue: Duration of Project. In Proposal H it is unclear what "duration" means when applied to change orders.

8. Issue: Risk-Free Return. Use of a current Treasury Bill rate as the base rate is preferred over using some new rate specified by OCE.

Views With Which CERL Disagrees

1. Issue: Risk-Free Return Factor.

a. Comment: the Risk-Free Return factor is unjustified.

b. CERL response: in order to take on the risk of a business enterprise, a contractor or A-E must expect to receive at least as much as he could in risk-free investment opportunities.

2. Issue: Fixed Asset Investment.

a. Comment: this factor should be eliminated.

b. CERL response: the factor is needed to discriminate among contracts that have varying degrees of *contractor-owned* facilities invested in a project.

3. Issue: Fixed Asset Investment.

a. Comment: the CERL policy of rewarding only contractor-owned fixed assets discriminates against those who must rent their equipment.

b. CERL response: CERL's position is that profit for rented equipment is already provided for in the rental fee estimated for such equipment. Since such fixed asset investment should be rewarded only once, additional fixed asset profit should not be allowed to the prime contractor who rents the equipment but does not sustain an ownership risk on the equipment.

APPENDIX C:
WEIGHTING ALGORITHMS FOR PROPOSAL I

The proposed profit-determination procedure for construction contracts requires consideration of the following seven profit factors: (1) Relative Difficulty of Work, (2) Contractor Participation, (3) Type of Contract, (4) Management Risks, (5) Duration of Project, (6) Fixed Asset Investment, and (7) Risk-Free Return. The algorithms which follow provide guidance for evaluating each of these profit factors and assigning each profit factor an appropriate weight for use on the Profit Objective Determination Worksheet (Figure C1). Each profit factor weight is multiplied by the appropriate profit factor rate in Figure C1 to determine the amount of profit attributable to that factor. The total Profit Objective is expressed as a percentage of total contract costs. Different rates have been assigned for use in three different contracting situations:

1. Basic construction contracts
2. Change orders settled before the fact
3. Change orders settled after the fact.

For a basic contract, "project" denotes the entire job. For change orders, "project" denotes only those activities affected by the change order.

PROFIT OBJECTIVE DETERMINATION WORKSHEET FOR CONSTRUCTION CONTRACTS						CONTRACT NO. MODIFICATION NO.
PROFIT FACTOR	RATE (%)			WEIGHT (0 – 1.0)	VALUE (%)	REMARKS
	BASIC	CHANGE ORDER				
		BEFORE	AFTER			
1. RELATIVE DIFFICULTY OF WORK	2.0	2.0	2.0			
2. CONTRACTOR PARTICIPATION	2.0	2.0	2.0			
3. TYPE OF CONTRACT	3.0	6.0	0.0			
4. MANAGEMENT RISKS	2.0	2.0	2.0			
5. DURATION OF PROJECT	2.0	2.0	2.0			
6. FIXED ASSET INVESTMENT	3.0	3.0	3.0			
7. RISK-FREE RETURN	TREASURY BILL RATE: _____			0.2		
PROFIT OBJECTIVE						

Figure C1. Proposal I Profit Objective Determination Worksheet for construction contracts.

Relative Difficulty of Work

This profit factor is weighted according to the amount of knowledge, skill, and experience the contractor needs to complete the project (Figure C2). The evaluation of the work's difficulty should consider the inherent difficulty of the project itself, not the capabilities of particular contractors doing the work.

Contractor Participation

The weight for this profit factor is based on the percentage of the work performed by the contractor. For basic contracts and change orders settled before the fact, the anticipated percentage of work performed by the contractor is used. For after-the-fact settlements, the actual percentage of the work performed by the contractor is used. If the contractor performs 20 percent or less of the work, a weight of 0.0 is assigned. If all of the work is performed by the contractor, the factor is weighted at 1.0. Intermediate values are shown in Figure C3.

Type of Contract

The profit-factor weights for type of contract will generally be within the ranges listed in Table C1. For each type of contract specified in Table C1, the weight assigned should consider whether the special provisions of the contract transfer a larger than normal percentage of the project risks to the contractor.

Management Risks

When the project entails essentially no performance risk, the factor is weighted at 0.0. Projects with the highest level of performance risk are weighted at 1.0, those of average risk at 0.5. Appropriate intermediate values are assigned to other projects. Considerations should include the quantity and diversity of principal work tasks required to accomplish the project, the labor intensity of the job, special control problems, "crashing" requirements, etc. In before-the-fact settlements for change orders, the impact on the basic contract work must also be considered. The profit factor weight for after-the-fact settlements is "0.0." However, in highly unusual cases where the contractor has demonstrated exceptional management efficiency and effectiveness in the Government's best interest to hold down costs, a weighting above 0.0 may be assigned for change-order settlements after the fact.

Table C1

Proposal I Factor Weights for Type of Contract

Contract Type	Weight Ranges
Cost Plus Fixed Fee	0.0 - 0.2
Cost Plus Incentive Fee	0.2 - 0.5
Fixed Price Incentive	0.5 - 0.7
Firm Fixed Price	0.7 - 1.0

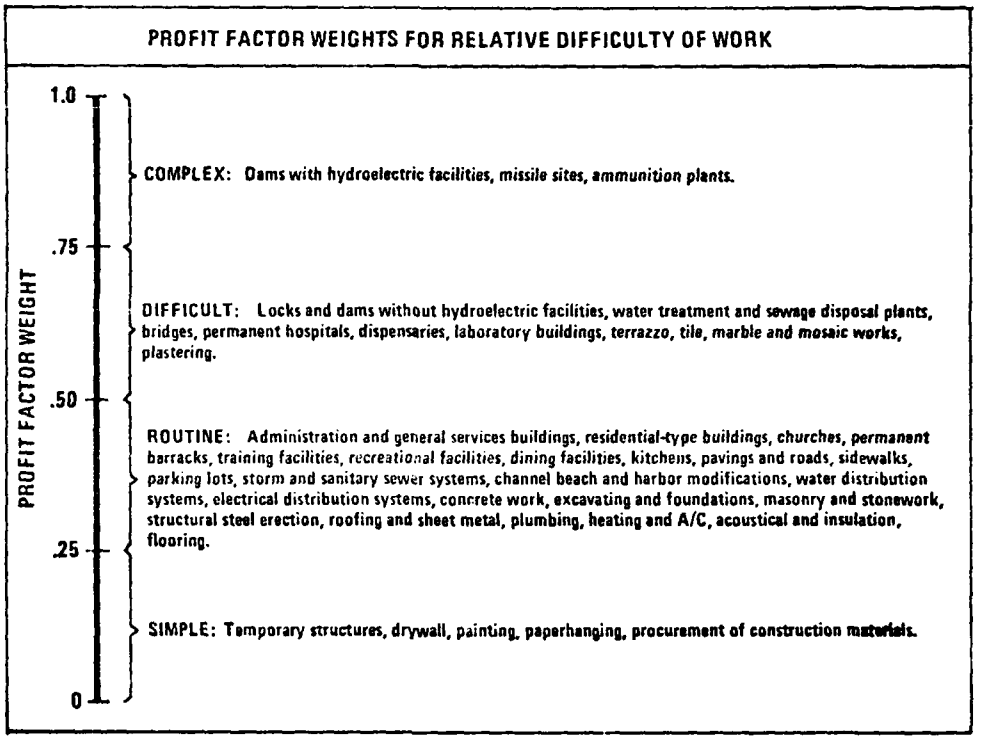


Figure C2. Proposal I factor weighting scale for Relative Difficulty of Work.

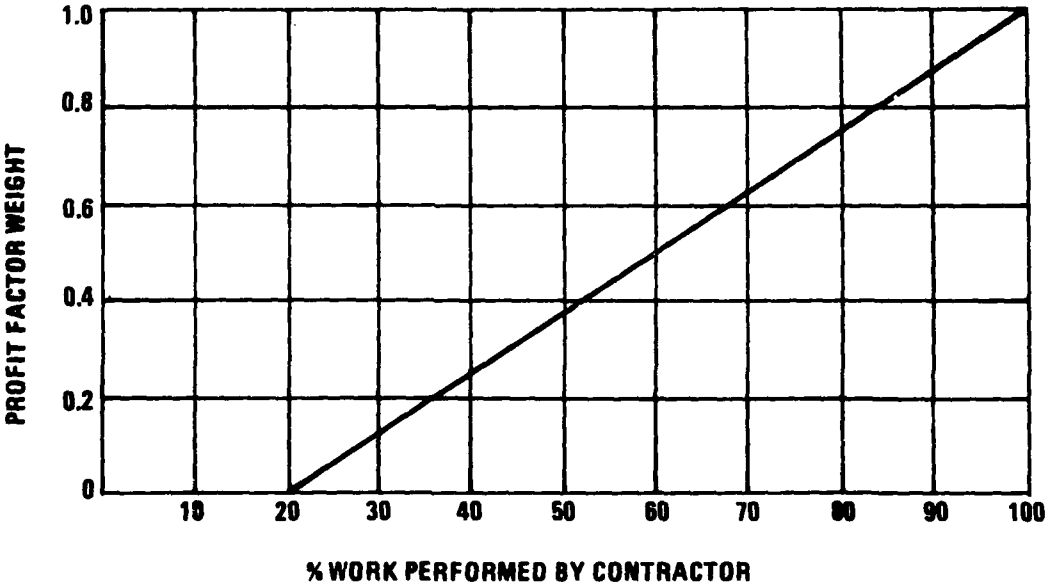


Figure C3. Proposal I factor weighting graph for Contractor Participation.

Duration of Project

This profit factor is weighted at 1.0 for projects of duration in excess of 24 months. The factor is weighted proportionally less for projects of shorter duration, as shown in Figure C4. "Duration" is the estimated total time required for contract performance. For change orders, the duration is the estimated effective time required to perform the change-order work.

Fixed Asset Investment

This factor allows compensation for contractor-owned investments in productive fixed assets such as equipment and computers. Excluded from consideration are rented and leased assets, land and buildings, assets whose investment costs are included in the contractor's overhead rates, and assets with an allowance for reimbursement of cost-of-facilities capital included in their cost rates.

The appropriate investment level and risk index should be selected from the index in Figure C5 to determine the profit-factor weight for fixed asset investments. For modifications, only those fixed assets used to perform the change-order work should be considered.

Risk-Free Return

The current 26-week Treasury Bill rate is used for projects lasting less than 1 year. The current 52-week rate is used for projects longer than 1 year. The current Treasury Bill rate can be found in the *Wall Street Journal* and in most major newspapers. The Federal Reserve system also releases a publication (available weekly and monthly) called *Selected Interest Rates and Bond Prices.*

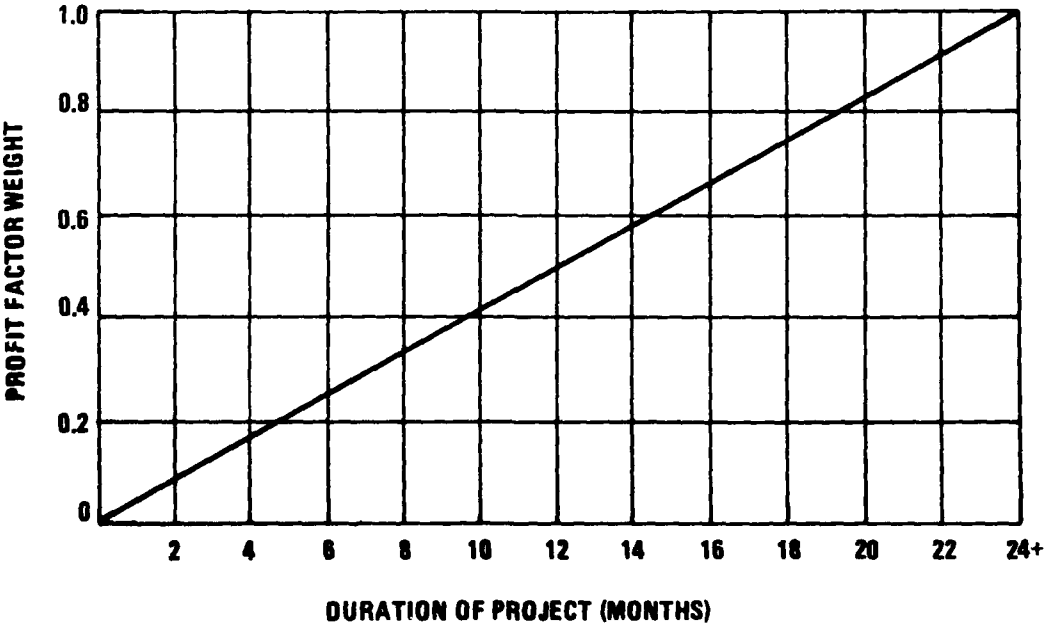


Figure C4. Proposal I factor weighting graph for Duration of Project.

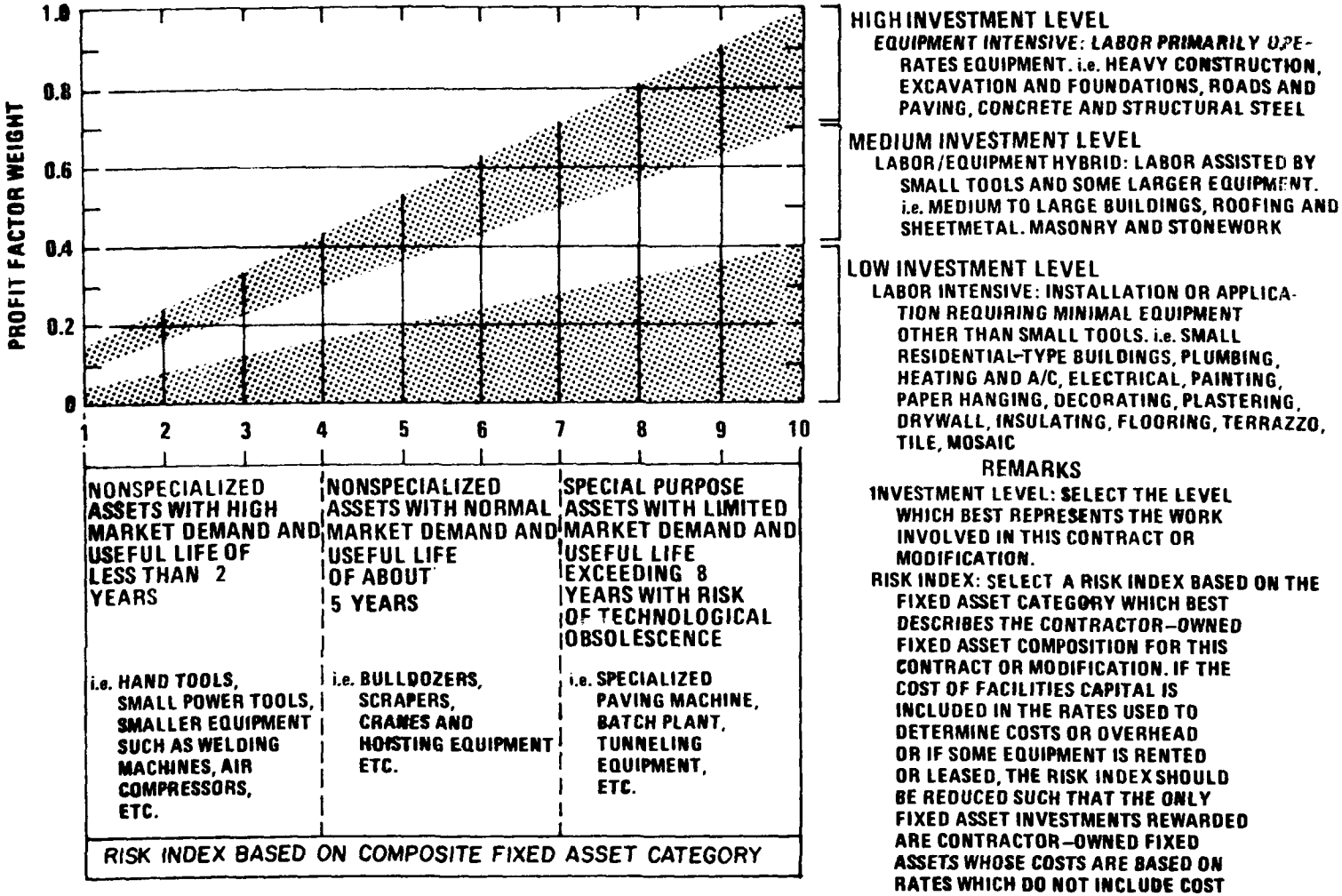


Figure C5. Proposal I factor weighting graph for Fixed Asset Investment.

APPENDIX D:

SUMMARY OF RESPONSES TO 21 JUNE 1979 LETTER CONCERNING PROPOSAL I

The following is a brief summary paraphrasing the significant comments from district and division offices received in response to a CERL-FS letter dated 21 June 1979, subject: Proposed Profit Determination Procedure for Use on Corps Construction Contracts. The responses are classified as being issues with which CERL either agrees or disagrees.

Views With Which CERL Agrees

1. Issue: Risk-Free Rate. Use the interest rate established by the Secretary of the Treasury under PL 92-41 instead of current Treasury Bill rates.

2. Issue: Relative Difficulty of Work. In Proposal I, delete the scalar weighting scheme for level of difficulty of work. The weighting of this factor should be redesigned to allow the contracting officer more flexibility.

3. Issue: Type of Contract. Explain the rationale for the rate differential between before-the-fact and after-the-fact settlements. Provide fixed weights for the type of contract; i.e., eliminate the ranges which allow the weights assigned to vary for the same type of contract. Re-examine the weighting and proportionality of the weights.

4. Issue: Management Risks. Include a before-the-fact incentive in this factor. Change the rate of after-the-fact change orders to 0. Delete the last sentence which refers to management efficiency in holding costs down for after-the-fact change orders.

CERL comment: CERL agrees in principle with these recommended changes. However, in the recommended method, the procedure is simplified by including Management Risk considerations under Relative Difficulty of Work.

5. Issue: Fixed Asset Investment. Duplicated allowances on contracts using equipment rate schedules that include the same factors should be avoided. Clarify position on what fixed assets are to be considered and when.

CERL comment: the former concern should be addressed in appropriate training manuals and courses, not in the ECI. The recommended ECI narrative was improved to note that only those assets *costed* in change orders should be considered and not to exclude certain assets that could be costed in overhead.

Views With Which CERL Disagrees

1. Issue: Fixed Asset Investment.

a. Comment: a contractor's investment in a job should not, in itself, be rewarded, but rather should be considered through evaluation of the cash flow necessary to perform the work.

b. CERL response: the contractor's investment in fixed assets and in current assets are distinct elements and should be addressed separately. Cash flow characteristics of projects influence how much current asset investment is needed, but do not distinguish between the different levels of fixed asset investment required on different projects. The factor Fixed Asset Investment is designed to provide a reward only for those fixed assets which the contractor owns and uses on a project.

2. Issue: Size of Job.

a. Comment: Proposal I penalizes small contractors since more profit is allowed on large contracts than on small ones.

b. CERL response: profit *rates* should be size independent. For a given rate, however, profit dollar amounts will vary since profit is expressed as a percentage of costs. Most arguments for considering size of job actually pertain to the size of the contingency allowance which should be allowed on a particular project. Contingency allowance is a cost consideration, not a valid profit consideration. A contractor is not allowed increased profits to compensate for the fact that during a particular year he may not have been able to fully employ all of his assets. Neither should a contractor who tackles a big job be given reduced dollar amounts of profit. For jobs of equal risk and complexity, big jobs require larger or longer investments of assets than small jobs and therefore merit larger dollar returns. The profit rates for both projects should be the same since the level of risk is the same. Return on investments of equal risk should be directly proportional to the level of investment. There may be justification for the contingency allowance rate to vary between a large and a small job of equal risks, depending on the particular circumstances, but this should be reflected in the cost portion of the estimate, not in the profit portion.

3. Issue: Risk-Free Return.

a. Comment: the Treasury Bill rate is not applicable to construction contracts.

b. CERL response: use of the Treasury rate is intended to serve only as a convenient indicator of prevailing market conditions, not as an indicator of how much "interest" is due. The factor was renamed Base Incentive to eliminate some of the confusion about its purpose.

4. Issue: Fixed Asset Investment Reward.

a. Comment: Proposal I yields too little profit for high investment level or equipment-intensive jobs, and too much profit on low investment level or labor-intensive jobs.

b. CERL response: note that for similar reasons, the rate assigned to the Fixed Asset Investment factor has been increased from 3 to 4-1/2 percent. However, the particular comparison implied by the comment is not valid because it is based on an experimental profit method specifically tailored for limited use with a CERL-developed, equipment-use-rate method which has since been discontinued.

APPENDIX E:

WEIGHTING ALGORITHMS FOR PROPOSAL J

The proposed profit determination procedure for A-E and other service-intensive contracts requires consideration of six profit factors: (1) Relative Difficulty of Work, (2) Contractor Participation, (3) Type of Contract, (4) Duration of Project, (5) Fixed Asset Investment, and (6) Risk-Free Return. The algorithms which follow provide guidance for evaluating these profit factors and assigning each an appropriate weight for use on the Profit Objective Determination Worksheet (Figure E1). Each profit factor weight is multiplied by the profit factor rate in Figure E1 to determine the amount of profit attributable to that profit factor. The total Profit Objective is expressed as a percentage of total contract costs. The word "project" denotes the entire job for a basic contract. For change orders, "project" denotes only those activities affected by the change order.

Relative Difficulty of Work

This profit factor is weighted according to the amount of knowledge, skill, and experience the contractor needs to complete the project (Figure E2). The evaluation of the work's difficulty should consider the inherent difficulty of the project itself, not the capabilities of particular contractors performing the work. Considerations should include the quantity and diversity of principal work tasks required to perform the project, special control problems, "crashing" requirements, etc. For change orders, impact on the original work must also be considered.

Contractor Participation

The weight for this profit factor is based on the percentage of the work performed by the contractor. For basic contracts and change orders settled before the fact, the anticipated percentage of work performed by the contractor is used. For after-the-fact settlements, the actual percentage of the work performed by the contractor is used. If the contractor performs 20 percent of the work or less, a weight of 0.0 is assigned. If all of the work is performed by the contractor, the factor is weighted at 1.0. Intermediate values are shown in Figure E3.

Type of Contract

The profit factor weights for type of contract will generally be within the ranges listed in Table E1. For each type of contract specified in Table E1, the weight assigned should consider

Table E1

Proposal J Factor Weights for Type of Contract

Contract Type	Weight Ranges
Cost Plus Fixed Fee	0.0 - 0.2
Cost Plus Incentive Fee	0.2 - 0.5
Fixed Price Incentive	0.5 - 0.7
Firm Fixed Price	0.7 - 1.0

PROFIT OBJECTIVE DETERMINATION WORKSHEET FOR AE AND OTHER SERVICE-INTENSIVE CONTRACTS				CONTRACT NO. / MODIFICATION NO.
PROFIT FACTOR	RATE %	WEIGHT (0-1.0)	VALUE %	REMARKS
1. RELATIVE DIFFICULTY OF WORK	40			
2. CONTRACTOR PARTICIPATION	20			
3. TYPE OF CONTRACT	30			
4. DURATION OF PROJECT	20			
5. FIXED ASSET INVESTMENT	1.0			
6. RISK-FREE RETURN — TREASURY BILL RATE: ____		0.2		
PROFIT OBJECTIVE				

Figure E1. Proposal J Profit Objective Determination Worksheet for A-E and other service-intensive contracts.

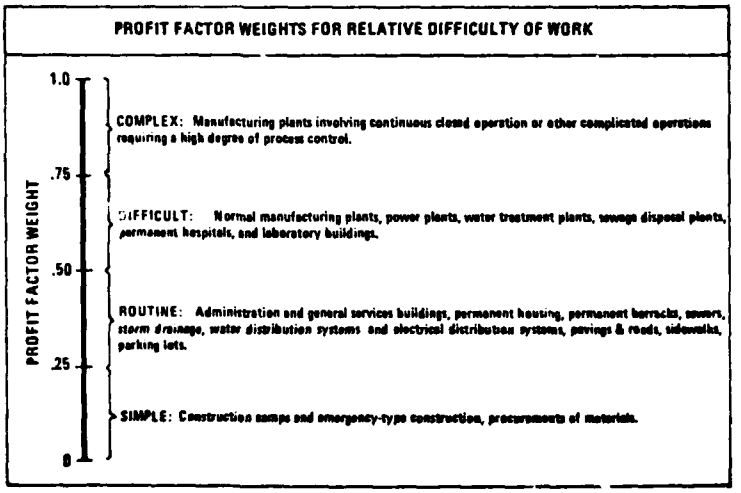


Figure E2. Proposal J factor weighting scale for Relative Difficulty of Work.

whether the special provisions of the contract transfer a larger than normal percentage of the project risks to the contractor.

Duration of Project

This profit factor is weighted at 1.0 for projects lasting 12 months or longer, and is weighted proportionally less for projects of shorter duration, as shown in Figure E4. "Duration" is the estimated total time required for contract performance. For change orders, the duration is the estimated effective time required to perform the change-order work.

Fixed Asset Investment

This factor allows compensation for contractor-owned investments in productive fixed assets such as equipment and computers. Excluded from consideration are rented and leased assets, land and buildings, assets whose investment costs are included in the contractor's overhead rates, and assets with an allowance for a reimbursement of cost-of-facilities capital included in their cost rates.

The profit factor weight for fixed asset investments can be determined from Figure E5 by selecting an appropriate investment level and risk index. For modifications, only those fixed assets used to perform the change-order work should be considered.

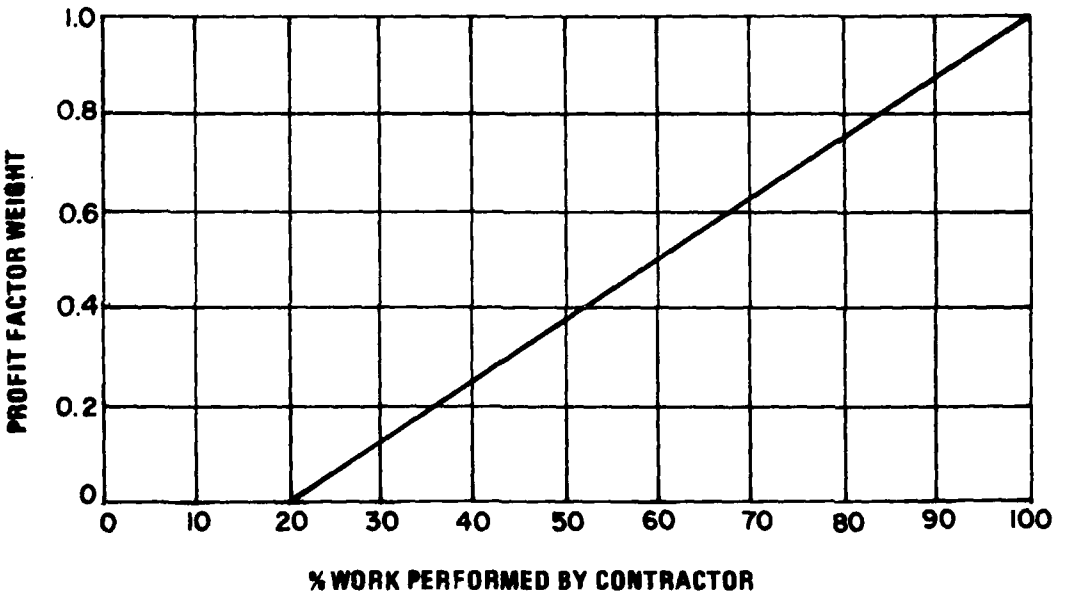


Figure E3. Proposal J factor weighting graph for Contractor Participation.

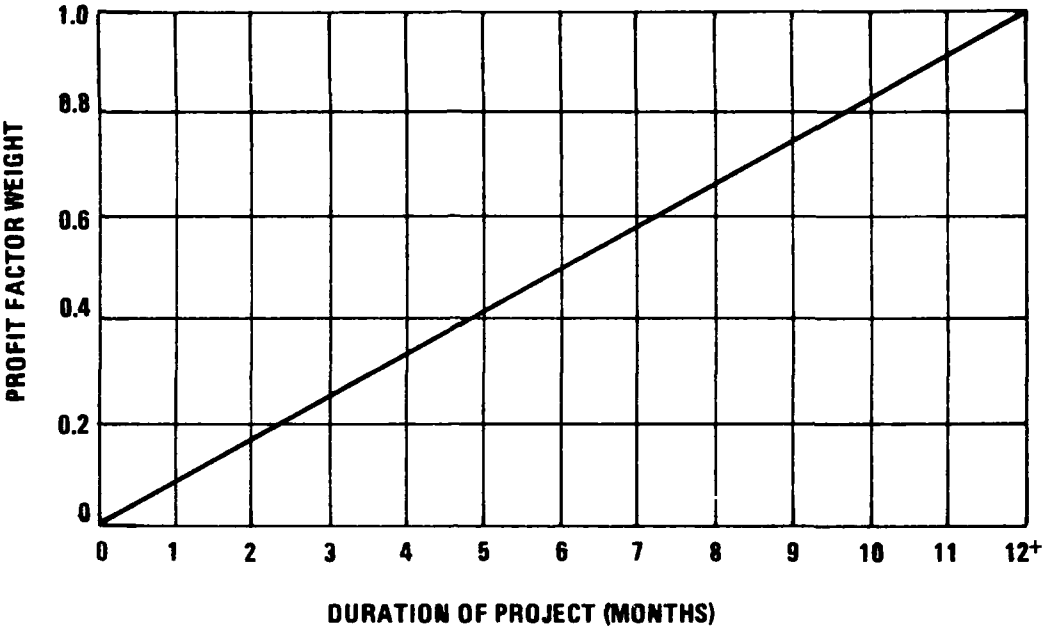


Figure E4. Proposal J factor weighting graph for Duration of Project.

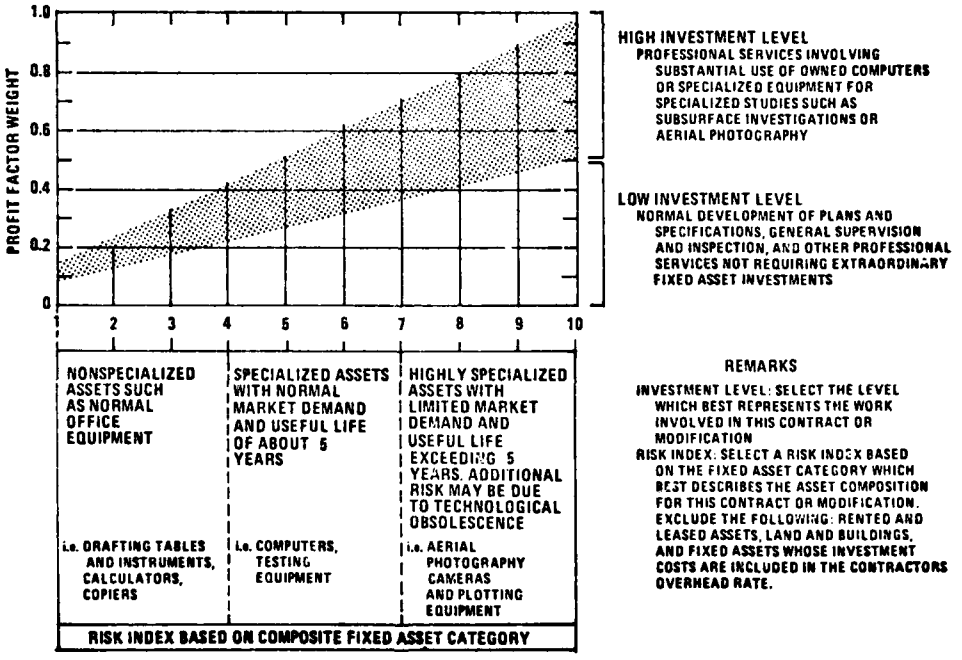


Figure E5. Proposal J factor weighting graph for Fixed Asset Investment.

Risk-Free Return

The current 26-week Treasury Bill rate is used for projects lasting less than 1 year. The current 52-week rate is used for projects longer than 1 year. The current Treasury Bill rate can be found in the *Wall Street Journal* and most major newspapers. The Federal Reserve system also releases a publication (available weekly and monthly) called *Selected Interest Rates and Bond Prices.*

APPENDIX F:

WEIGHTING ALGORITHMS FOR PROPOSAL K

Proposal K is the short method of profit objective determination for unaudited (under $100,000) A-E and other service-intensive contracts with no significant fixed asset investment (Figure F1).

Type of Contract

The work is classified as either firm price or cost plus.

Relative Difficulty of Work

The following may be used as a guide for determining the relative difficulty of work.

Complex

This category includes work such as manufacturing plants involving continuous closed operation or other complicated operations requiring a high degree of process control.

Difficult

Included here is work such as normal manufacturing plants, power plants, water treatment plants, sewage disposal plants, permanent hospitals, and laboratory buildings.

Routine

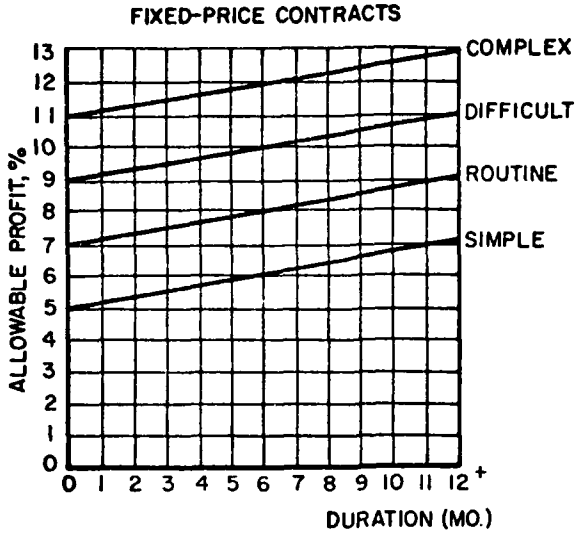
Work in this category includes administration and general services buildings, permanent housing, permanent barracks, sewers, storm drainage, water distribution systems, electrical distribution systems, pavings and roads, sidewalks, and parking lots.

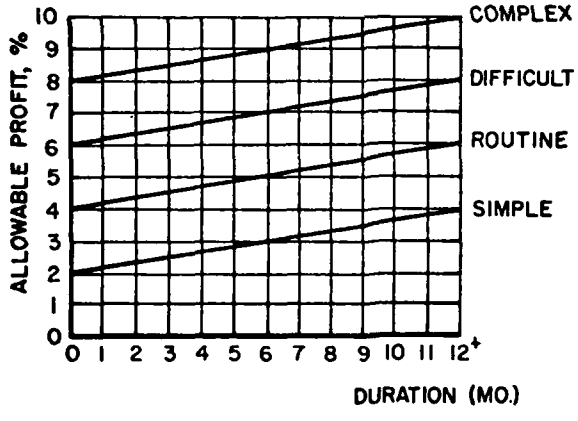
Simple

This applies to work such as construction camps and emergency-type construction.

Duration of Project

The estimated total time required for contract performance should be used. For change orders, the duration is the estimated effective time required to perform the change-order work.





TYPE CONTRACT
(CHECK ONE)

——— FIXED PRICE

——— COST PLUS

DIFFICULTY
(CHECK ONE)

——— SIMPLE

——— ROUTINE

——— DIFFICULT

——— COMPLEX

DURATION _____ MO.

PROFIT OBJECTIVE _____ %

Figure F1. Proposal K Profit Objective Determination Worksheet for A-E contracts.

APPENDIX G:

SUMMARY OF RESPONSES TO 21 JUNE 1979 LETTER CONCERNING PROPOSALS J AND K

The following is a brief, paraphrased summary of the significant comments received in response to a CERL-FS letter dated 21 June 1979, subject: Proposed Profit Determination Procedure for Use on Corps A-E Contracts. The responses are classified as being issues with which CERL either agrees or disagrees.

Views With Which CERL Agrees

1. Issue: Relative Difficulty of Work.

a. Comment: reword the examples of project difficulty to make them more applicable to actual projects and also include studies and reports in the definition.

b. CERL response: the new examples in the recommended method are intended to be illustrative only.

2. Issue: Risk-Free Return.

a. Comment: use the interest rates established by the Secretary of the Treasury under PL 92-41 instead of the current Treasury Bill rates.

b. CERL response: the factor was also renamed Base Incentive.

3. Issue: Amount of Profit.

a. Comment: Proposals J and K yield too little profit when applied to small contracts.

b. CERL response: the procedure has been adjusted to yield higher profit objectives.

4. Issue: Fixed Asset Investment.

a. Comment: such a factor is not appropriate for A-E contracts.

b. CERL response: this factor was deleted. It is not a useful discriminator of risk when applied to A-E contracts.

5. Issue: Fixed Asset Investment.

a. Comment: the exclusion of investment costs included in overhead rates will defeat the purpose of this factor.

b. CERL response: this is generally true; however, it is no longer an issue since the factor has been deleted.

6. Issue: Flexibility for Negotiations.

a. Comment: text should provide areas that allow greater flexibility to negotiators.

b. CERL response: the factor Relative Difficulty of Work has been revised and is intended to provide this flexibility. The narrative on how to weight the factor is a guide, but still allows the negotiator considerable flexibility.

7. Issue: Relative Difficulty of Work.

a. Comment: increase the rate of this factor to provide sufficient flexibility for small projects.

b. CERL response: the rate should be higher. However, CERL disagrees with the implication that "size of job" should be a consideration in weighting this factor. Incentive should increase as the relative difficulty increases, regardless of the size of the job.

8. Issue: Type of Contract.

a. Comment: reword instructions on how to apply type of contract. Refer to fee limitation requirements.

b. CERL response: application of this profit factor in the recommended method is less subjective and reference is made to Chapter 10, U.S. Code, paragraph 2306(d) (10 USC 2306[d]).

9. Issue: Consistency Between Methods.

a. Comment: Proposals J and K do not yield similar results in some cases.

b. CERL response: this is true because the short form (Proposal K) considers fewer factors and is far less subjective than Proposal J. However, in the recommended procedures, this problem is alleviated somewhat by the elimination of the Fixed Asset factor. Moreover, the revised "short method" is calibrated to yield somewhat higher profits.

Views With Which CERL Disagrees

1. Issue: Size of Job.

a. Comment: on a large, complex job, Proposal J allows a profit rate that is significantly higher than allowed by EM 1110-345-30. A size-of-job factor should be retained.

b. CERL response: the EM 1110-345-30 method provides for decreasing profit rates as the size of job increases. The rationale for using such a factor actually pertains to the size of contingency allowance which should be allowed on a particular project. Contingency allowance is a *cost* consideration, not a valid profit consideration. Since the Government does not allow A-Es increased profits when they have had a bad year and cannot cover costs, neither should the Government penalize those A-Es who handle big projects. Profit rates should not vary with size of job; contingency allowances, however, should vary depending on the circumstances, but should be addressed in the cost portion of the estimate.

2. Issue: Relative Difficulty of Work.

a. Comment: use a bell-shaped curve to assign a weight to this factor.

b. CERL response: allowing a higher weight for routine and difficult jobs, and a lower weight for simple and complex jobs, does not provide the increasing incentive that should be associated with projects of increasing difficulty. It appears that this recommendation is essentially intended to include, by manipulating the Relative Difficulty factor weights, a size-of-job consideration.

3. Issue: Risk-Free Return.

a. Comment: this factor should be eliminated.

b. CERL response: this factor is necessary to make the profit procedure responsive to prevailing market conditions. However, the factor has been renamed Base Incentive. This is intended to eliminate some of the confusion about its purpose.

4. Issue: Amount of Profit Allowed.

a. Comment: the profit rate may be too high for contractors with significant profit-sharing and bonus plans.

b. CERL response: the CERL method is a rule-of-thumb approach designed to yield a fair and reasonable profit for the *average* contractor. Although it may yield results that are too high in some cases, it is not practical to design a method tailored to the characteristics of specific A-E firms. The profit procedure is, however, designed to yield reasonable results for average contracting situations.

5. Issue: Application of Methods.

a. Comment: clarify that Proposal J applies only to contracts over $100,000. The short form (Proposal K) seems to have no use.

b. CERL response: it is recommended that the "long" form of the procedure be allowed on all contracts and that the "short" form be permitted as an optional method only on contracts less than $100,000 which are settled before the fact.

6. Issue: Assistance by Government.

a. Comment: this factor should be retained since the amount of Government assistance influences the amount of risk.

b. CERL response: the scope of work would be less when Government assistance is provided, and therefore the cost base to which the profit rate is applied would also be less. Regardless, such considerations may still be addressed when evaluating the Relative Difficulty factor.

7. Issue: Type of Contract.

a. Comment: this factor should be eliminated since in most districts, the contracts are always Firm Fixed Price.

b. CERL response: the recommended procedure is designed to address the entire spectrum of Corps contracting needs.

APPENDIX H:

RECOMMENDED CHANGES TO ENGINEER CONTRACT INSTRUCTIONS

This appendix presents the text of the recommended changes to ECI, Section III, Part 8:

3-808 Profit, Including Fees Under Cost-Reimbursement Type Contracts.

3-808.2 Weighted Profit Factor Guidelines for Determining Fair and Reasonable Profit Incentives for Use in Construction and A-E Contracts and Modifications. In preparing Government estimates and/or where profit is negotiated as an element of price -- whether for prime contract or subcontract -- a fair and reasonable profit will be determined for each procurement action using the following procedures as a guide:

1. Procedure for Use on Construction Contracts.

a. Six profit factors are considered; five are evaluated on a scale of 0 to 1. The weight assigned is multiplied by the predetermined rates shown Table H1 to give a value for each factor in terms of percentage markup of cost. For the sixth factor, the appropriate rate is assigned and is multiplied by the predetermined weight shown below to give the factor value. The sum of values is the profit objective. Normally, the "Before Fact" rate column is used; however, if the contract price is settled after the work is done, the "After Fact" rates are used. These rates reflect the fact that the contractor is exposed to less risk when he settles after the fact.

b. Based on the circumstances of each procurement action, each of the five factors below will be assigned an appropriate weight from 0 to a maximum of 1.

(1) **Relative Difficulty of Work**. This factor is weighted from 0 (for the simplest of jobs) to 1 (for the most complex jobs). Consideration includes the inherent difficulty of the work itself, the number and diversity of tasks required to do the work, special control requirements, "crashing" requirements, and site conditions. The severity of impact on the basic contract work is considered when change orders are evaluated. The amount of contractor participation is also a consideration. Under normal circumstances, if a prime contractor is essentially functioning only as a broker for subcontractor services, a weight of 0.1 for this factor is appropriate when applied to the cost of the prime contract.

(2) **Contractor Participation**. This factor is weighted according to the relative amount of work performed by the contractor. If the contractor performs 20 percent or less of the dollar

Table H1

Profit Factor Rates for Construction Contracts

Factor	Rates (%) Before Fact	After Fact	Weight (0-1)	Value %
Relative Difficulty of Work	2.6	1.3		
Contractor Participation	1.2	1.2		
Type of Contract	2.0	0.0		
Duration of Work	1.4	1.4		
Fixed Asset Investment	4.5	4.5		
Base Incentive			0.4	____
		Profit Objective:		

value of the work, a weight of 0 is assigned. If all the work is performed by the contractor, a weight of 1 is assigned. Intermediate weights are assigned as a linear function of the percentage of work performed by the contractor, from 20 to 100 percent.

(3) **Type of Contract**. This factor is normally weighted as shown in Table H2. If the contract type is a hybrid of the types listed, or if the terms of the contract shift an unusual amount of risk to or from the contractor, then the weight should be modified accordingly. Also observe the limitation of 10 USC 2306(d) for Cost Plus Fixed Fee contracts.

(4) **Duration of Work**. This factor is weighted linearly from 0 (for a hypothetical job of no duration) to 1 (for jobs of 24 months' duration). Jobs longer than 24 months are also weighted at 1. For change orders, the duration is the effective time required to perform the work required by the change order only.

(5) **Fixed Asset Investment**. This factor is weighted from 0 to 1 according to both the intensity of use of contractor-owned fixed asset investments on a job and the degree of investment risk associated with the particular fixed assets used on the job.

Figure H1 is a guide for determining an appropriate factor weight. For modifications, only those fixed assets costed in the change-order work are considered. Note that this factor applies to the fixed assets used on a job that are actually owned by a contractor. Thus, for this factor, 0 is an appropriate weight for a prime contractor who is essentially functioning only as a broker for subcontracting services.

c. The rate for the Base Incentive factor is the most current rate issued semiannually by the Secretary of the Treasury, as directed by PL 92-41. This factor should not be construed as interest nor should it be confused with Facilities Capital Cost of Money. Note that the source for determining this rate is used for convenience only. The factor is intended to provide at least as much incentive to the contractor as is provided by relatively risk-free investment opportunities available in other markets.

2. Procedure for Use on A-E Contracts.

a. Five profit factors are considered (Table H3). Four factors are evaluated on a scale of 0 to 1. The weight assigned is multiplied by the predetermined rates shown below to give the value for each factor in terms of percentage markup of cost. For the fifth factor, the appropriate rate is assigned and is multiplied by the predetermined weight shown below to give the factor value. The sum of the values is the profit objective.

b. Based on the circumstances of each procurement action, each of the four factors below will be assigned an appropriate weight from 0 to a maximum of 1.

(1) **Relative Difficulty of Work**. This factor is weighted from 0 (for the simplest of jobs) to 1 (for the most complex jobs). Considerations include the inherent difficulty of the work, the degree of creativity required, the amount of design flexibility allowed, the amount and types of labor skills required, the amount of principal time required, severity of scheduling requirements, and the number and type of options included. Figure H2 is a guide for determining an

Table H2

Weighting by Contract Type

Contract Type	Weight
Firm Fixed Price	1.0
Fixed Price Incentive	0.7
Cost Plus Incentive Fee	0.3
Cost Plus Fixed Fee	0.0

Table H3

Profit Factor Rates for A-E Contracts

Factor	Rate (%)	Weight (0-1)	Value (%)
Relative Difficulty of Work	4.6		
Contractor Participation	2.2		
Type of Contract	2.5		
Duration of Work	1.4		
Base Incentive		0.5	____
	Profit Objective:		

appropriate weight. For contracts settled after performance of the work, half the weight that would normally be used is assigned.

(2) **Contractor Participation**. Same as in paragraph 1b(2) above.

(3) **Type of Contract**. Same as in paragraph 1b(3) above. Additionally, if the contract is settled after the work is done, a weight of 0 is assigned to this factor.

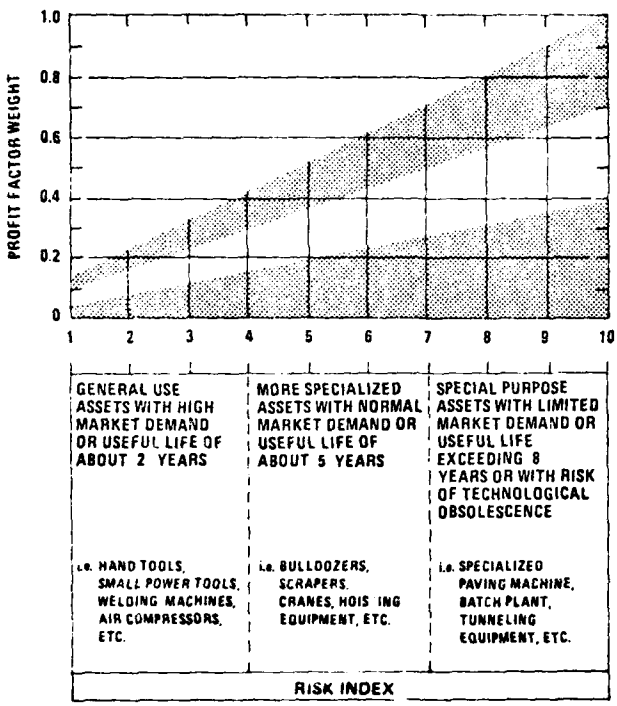
(4) **Duration of Work**. Same as in paragraph 1b(4) above.

c. Base Incentive: same as in paragraph 1c above.

3. Optional Procedure for Use on A-E Contracts That Are Less Than $100,000 and Are Settled Before Performance of the Work.

a. Three factors are considered using the graphs in Figure H3. The profit objective is derived by first selecting the appropriate set of graphs to use, either for Fixed-Price or Cost-Reimbursable contracts. Then the work is defined as simple, routine, difficult, or complex. The profit objective is the ordinate where the appropriate Relative Difficulty line intersects the abscissa for the appropriate Duration of Work.

b. The considerations in paragraph 2b(1) above are used in determining the work to be simple, routine, difficult, or complex.



HIGH INVESTMENT BAND
EQUIPMENT INTENSIVE: LABOR PRIMARILY OPERATES EQUIPMENT i.e. HEAVY CONSTRUCTION, EXCAVATION AND FOUNDATIONS, ROADS AND PAVING, STRUCTURAL STEEL

MEDIUM INVESTMENT BAND
LABOR/EQUIPMENT HYBRID: LABOR ASSISTED BY SMALL TOOLS AND SOME LARGER EQUIPMENT. i.e. MEDIUM TO LARGE BUILDINGS, CONCRETE WORK, SEWERS

LOW INVESTMENT BAND
LABOR INTENSIVE: INSTALLATION OR APPLICATION REQUIRING MINIMAL EQUIPMENT OTHER THAN SMALL TOOLS, i.e. SMALL RESIDENTIAL TYPE BUILDINGS, PLUMBING, ROOFING, HEATING AND A/C, ELECTRICAL, PAINTING, MASONRY, PAPER HANGING, DECORATING, PLASTERING, DRYWALL, INSULATING, FLOORING, TERRAZZO

REMARKS

INVESTMENT LEVEL:
SELECT AN INVESTMENT LEVEL WITHIN THE APPROPRIATE INVESTMENT BAND THAT BEST REPRESENTS THE OVERALL NATURE OF THE WORK.

RISK INDEX:
SELECT A RISK INDEX NUMBER THAT BEST REPRESENTS THE AVERAGE DEGREE OF INVESTMENT RISK FOR THE OVERALL *CONTRACTOR-OWNED FIXED ASSETS* REQUIRED FOR THE JOB.

FACTOR WEIGHT:
ASSIGN A WEIGHT THAT IS EQUAL TO THE HEIGHT OF THE SELECTED RISK INDEX LINE WHERE THAT INDEX LINE INTERSECTS THE SELECTED INVESTMENT LEVEL.

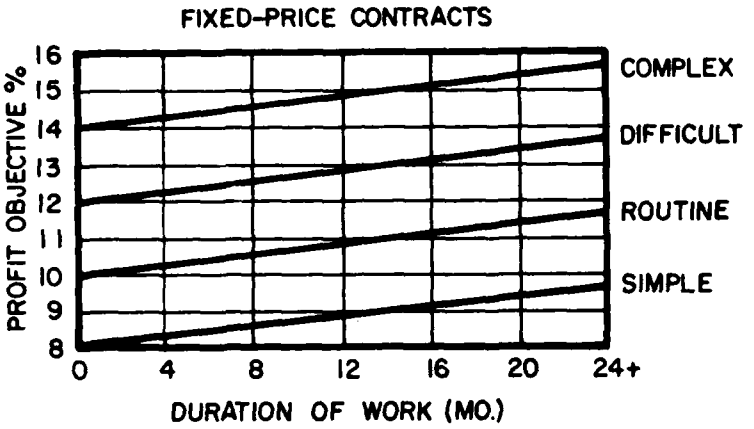
Figure H1. Proposed Figure 3-808-1 -- weights for Fixed Asset Investment.

RELATIVE DIFFICULTY OF WORK

Weight		Weight	
0.8–1.0	COMPLEX: Designs requiring knowledge of advanced technology, consummate design skill, extensive criteria definition, extensive custom detailing, or studies dealing with state-of-the-art technology. Examples: hospitals, ammunition disposal facilities, energy monitoring and control systems, propellent manufacturing plants.	0.2–0.5	ROUTINE: Designs of conventional character, requiring standard basic design and engineering services; or studies involving analysis of standard technology or standard systems. Examples: administrative buildings, barracks, warehouses, roads, target simulators, project development brochures.
0.5–0.8	DIFFICULT: Designs requiring above average design and engineering skill, extensive standard detailing, and a significant level of coordination; or studies involving analysis of complex, non-standard systems. Examples: commissaries, cold storage plants, aircraft hangars, industrial waste treatment, laboratories, flight simulators, dental clinics, large HVAC systems.	0.0–0.2	SIMPLE: Designs requiring cookbook design and engineering services; or studies which are essentially data collection efforts. Examples: Small pre-engineered buildings, standard family housing, tactical equipment shop, storm window additions, insulation upgrade, as-built drawings.

Additional Considerations: Degree of creativity required, amount of design flexibility allowed, amount and type of labor skills required, amount of principal time required, schedule requirements, and number and type of options included.

Figure H2. Proposed Figure 3-808-2 -- factor weights for relative difficulty of A-E work.



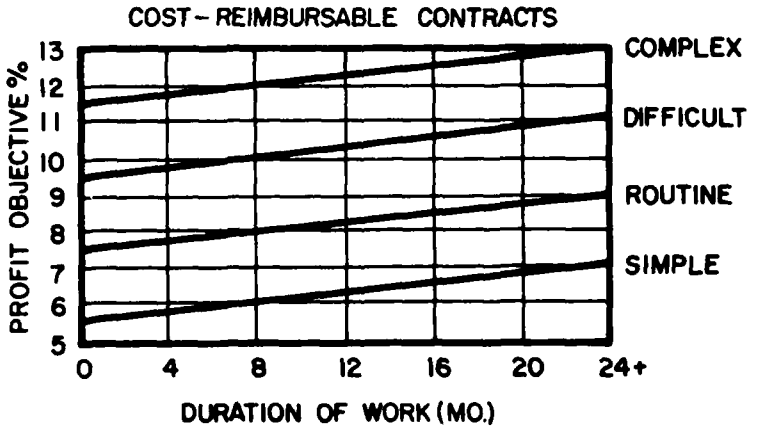


Figure H3. Proposed Figure 3-808-3. Graphs for use with optional A-E profit method.

APPENDIX I:

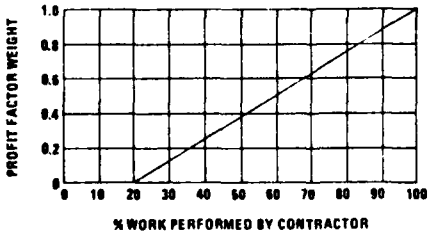
PROPOSED ENGINEER FORMS

PROFIT OBJECTIVE DETERMINATION WORKSHEET FOR CONSTRUCTION CONTRACTS					INVITATION/CONTRACT NO.
					MODIFICATION NO.
PROFIT FACTOR	RATE % BEFORE THE FACT	RATE % AFTER THE FACT	WEIGHT (0–1.0)	VALUE (%)	REMARKS
1. RELATIVE DIFFICULTY OF WORK	2.6	1.3			
2. CONTRACTOR PARTICIPATION	1.2	1.2			
3. TYPE OF CONTRACT	2.0	0.8			
4. DURATION OF WORK	1.4	1.4			
5. FIXED ASSET INVESTMENT	4.5	4.5			
6. BASE INCENTIVE			0.4		
PROFIT OBJECTIVE					

① RELATIVE DIFFICULTY OF WORK

The weighting of this factor is based on the complexity of the job. Things to consider: the inherent difficulty of the work itself, number and diversity of tasks necessary to complete the work, special control problems, crashing requirements, site conditions, etc. When evaluating change orders, the severity of impact on the basic contract work is considered. The amount of contractor participation is also a consideration. If a prime contractor is essentially functioning only as a broker for subcontractor services, a weight of 0.1 is appropriate.

② CONTRACTOR PARTICIPATION

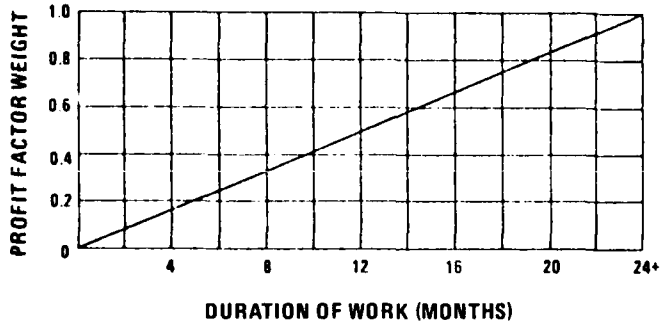


③ TYPE OF CONTRACT

	Profit Factor Weight
Firm Fixed Price	1.0
Fixed Price Incentive	0.7
Cost Plus Incentive Fee	0.3
Cost Plus Fixed Fee	0.0

Figure I1. ENG Form XXXXa (proposed).

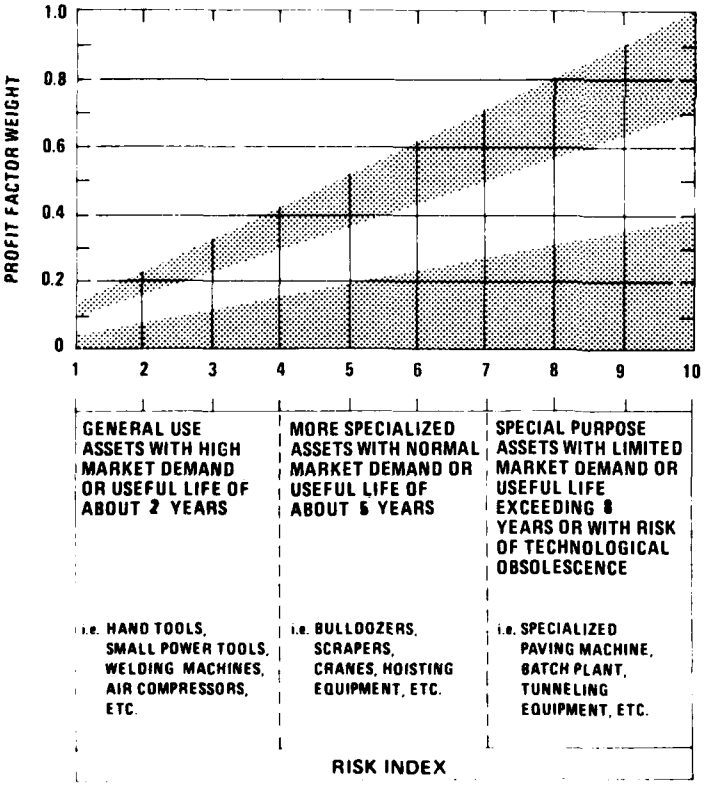
④ DURATION OF WORK



⑥ BASE INCENTIVE

Use rate (to nearest tenth) established by the Secretary of the Treasury as provided by PL 92-41. The current rate can be found semiannually (December-January and June-July) in the Federal Register.

⑤ FIXED ASSET INVESTMENT



HIGH INVESTMENT BAND
EQUIPMENT INTENSIVE: LABOR PRIMARILY OPERATES EQUIPMENT. i.e. HEAVY CONSTRUCTION, EXCAVATION AND FOUNDATIONS, ROADS AND PAVING, STRUCTURAL STEEL

MEDIUM INVESTMENT BAND
LABOR/EQUIPMENT HYBRID: LABOR ASSISTED BY SMALL TOOLS AND SOME LARGER EQUIPMENT. i.e. MEDIUM TO LARGE BUILDINGS, CONCRETE WORK, SEWERS

LOW INVESTMENT BAND
LABOR INTENSIVE: INSTALLATION OR APPLICATION REQUIRING MINIMAL EQUIPMENT OTHER THAN SMALL TOOLS, i.e. SMALL RESIDENTIAL TYPE BUILDINGS, PLUMBING, ROOFING, HEATING AND A/C, ELECTRICAL, PAINTING, MASONRY, PAPER HANGING, DECORATING, PLASTERING, DRYWALL, INSULATING, FLOORING, TERRAZZO

REMARKS

INVESTMENT LEVEL:
SELECT AN INVESTMENT LEVEL WITHIN THE APPROPRIATE INVESTMENT BAND THAT BEST REPRESENTS THE OVERALL NATURE OF THE WORK.

RISK INDEX:
SELECT A RISK INDEX NUMBER THAT BEST REPRESENTS THE AVERAGE DEGREE OF INVESTMENT RISK FOR THE OVERALL CONTRACTOR-OWNED FIXED ASSETS *REQUIRED FOR THE JOB*.

FACTOR WEIGHT:
ASSIGN A WEIGHT THAT IS EQUAL TO THE HEIGHT OF THE SELECTED RISK INDEX LINE WHERE THAT INDEX LINE INTERSECTS THE SELECTED INVESTMENT LEVEL

Figure 11. (Cont'd).

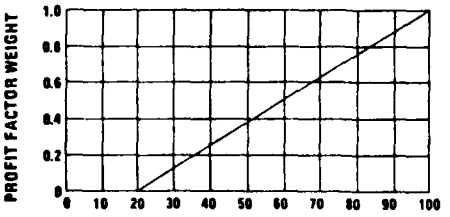
PROFIT OBJECTIVE DETERMINATION WORKSHEET FOR ARCHITECT-ENGINEER CONTRACTS				CONTRACT NO.
				MODIFICATION NO.
PROFIT FACTOR	RATE %	WEIGHT (0-1.0)	VALUE %	REMARKS
1. RELATIVE DIFFICULTY OF WORK	4.6			
2. CONTRACTOR PARTICIPATION	2.2			
3. TYPE OF CONTRACT	2.5			
4. DURATION OF WORK	1.4			
5. BASE INCENTIVE		0.5		
PROFIT OBJECTIVE				

① RELATIVE DIFFICULTY OF WORK

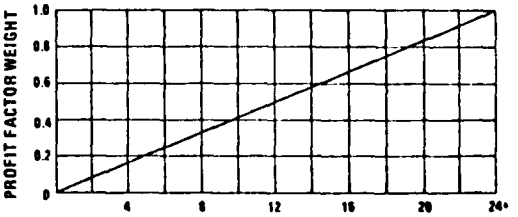
Weight	
0.8–1.0	COMPLEX: Designs requiring knowledge of advanced technology, consummate design skill, extensive criteria definition, extensive custom detailing; or studies dealing with state-of-the-art technology. Examples: hospitals, ammunition disposal facilities, energy monitoring and control systems, propellent manufacturing plants.
0.5–0.8	DIFFICULT: Designs requiring above average design and engineering skill, extensive standard detailing, and a significant level of coordination; or studies involving analysis of complex, non-standard systems. Examples: commissaries, cold storage plants, aircraft hangars, industrial waste treatment, laboratories, flight simulators, dental clinics, large HVAC systems.
0.2–0.5	ROUTINE: Designs of conventional character, requiring standard basic design and engineering services; or studies involving analysis of standard technology or standard systems. Examples: administrative buildings, barracks, warehouses, roads, target simulators, project development brochures.
0.0–0.2	SIMPLE: Designs requiring cookbook design and engineering services; or studies which are essentially data collection efforts. Examples: Small pre-engineered buildings, standard family housing, tactical equipment shop, storm window additions, insulation upgrade, as-built drawings.

Additional Considerations: Degree of creativity required, amount of design flexibility allowed, amount and type of labor skills required, amount of principal time required, schedule requirements, and number and type of options included.

② CONTRACTOR PARTICIPATION



④ DURATION OF WORK



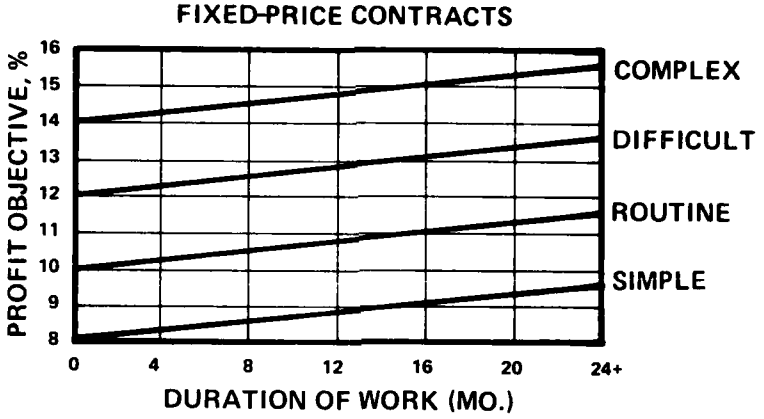
③ TYPE OF CONTRACT

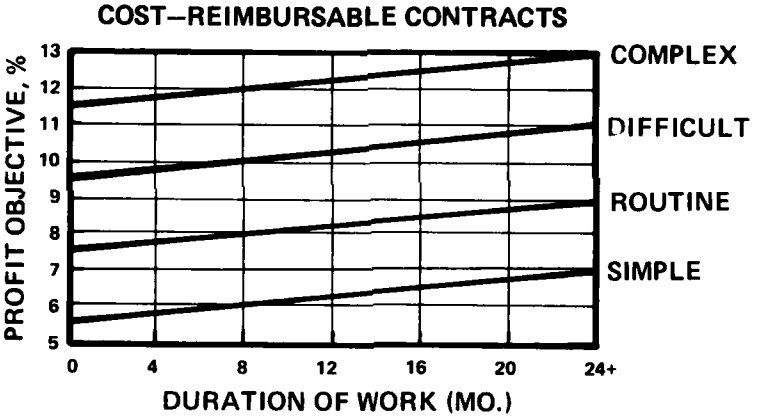
	Profit Factor Weight
Firm Fixed Price	1.0
Fixed Price Incentive	0.7
Cost Plus Incentive Fee	0.3
Cost Plus Fixed Fee	0.0

⑤ BASE INCENTIVE

Use rate (to nearest tenth) established by the Secretary of the Treasury as provided by PL 92-41. The current rate can be found semiannually (December-January and June-July) in the Federal Register.

Figure 12. ENG Form XXXXb (proposed).





TYPE CONTRACT
(CHECK ONE)

_____ FIXED PRICE

_____ COST–REIMBURSABLE

DIFFICULTY
(CHECK ONE)

_____ COMPLEX
_____ DIFFICULT
_____ ROUTINE
_____ SIMPLE

DURATION _____ MO.

PROFIT OBJECTIVE _____ %

Optional Form for Profit Determination for A-E Contracts

Figure 13. ENG Form XXXXc (proposed).

APPENDIX J:

CALIBRATION RATIONALE FOR RECOMMENDED PROFIT METHODS

The rationale for calibrating the recommended profit methods is based on the concept that Return on Investment (ROI) equals Profit Margin times Turnover, or,

$$\frac{Profit}{Assets} = \frac{Profit}{Volume} \times \frac{Volume}{Assets}$$

The term "profit" is used in the context of Government contracting, not in the normal business context. Profit is roughly equivalent to income before taxes, interest, and unallowable costs. Volume may be measured in terms of allowable costs or in terms of price; if volume is measured in terms of allowable costs, then "profit margin" is the same as "markup."

The underlying assumption for the rationale is that firms exposing themselves to the same amount of risk should receive the same annual rate of return on their investments. Another underlying assumption is that the calibration should be based on the performance of an average, prudent contractor or A-E who does an average amount of business. If a particular firm is very efficient and annually does more than the average amount of work -- i.e., has a higher-than-average turnover -- one would expect that firm's ROI to increase even though the markups applied are the same as for an average contractor or A-E. Conversely, if a firm is inefficient or cannot get enough work during the year, its overall ROI for the year would be less than average, even though average markups were received on the jobs during that year. That firm can rightly complain that applying an average markup to a particular job would not enable it to make an average ROI overall for that year. The Corps' profit procedure, to be reasonable, should provide enough incentive to induce an average firm to assume the risks of a particular job and, to be fair, should not be tailored to a particular firm's financial situation, whether that situation be good or bad. Thus, as much as possible, appropriate industry averages are used as the basis for this calibration.

The amount of incentive to be provided is structured as the sum of a Risk-Free Return component and a Premium For Risk component. The Risk-Free Return component is designed to provide a suitable base incentive that is generally comparable to the incentive offered by alternative investment opportunities that are relatively free of risk. This component makes the profit procedure sensitive to changing market and economic conditions. The Premium For Risk component is designed to provide *additional* incentive to accept the risks of a particular project. Since some projects are more risky than others, a differential premium is designed into the profit procedure.

An analysis of RMA's financial data for firms in 16 different types of Corps-related construction industries for 1976 and 1977 reveals that the average turnover by type of industry ranges from 1.7 to 3.2.[6] The average turnover for some 2300 construction firms in the 16 industries is about 2.5, a figure which is used as the starting point for calibrating the construction profit model. Similarly, the RMA financial data on A-E firms for 1976 and 1977 reveal that the 2-year average turnover for A-E firms is about 2.0 (Tables J1 and J2).

An arbitrary "ceiling rate" of 30 percent (annual rate) is assumed as an appropriate ROI for the most risky construction and A-E jobs. Dividing this ROI ceiling rate by an average turnover of 2.5 for the construction industry yields a markup ceiling of 12 percent for the "average" construction industry. Note that the industry types with higher turnovers should theoretically be assigned lower markup ceilings for the same ROI rate. However, it would be

[6] *Statement Studies* (Robert Morris Associates, 1976, 1977).

Table J1

1976 Business Statistics for Some Construction and A-E Firms

Industry	Number of Firms	Total Revenue (TR) ($1000)	Total Assets (TA) ($1000)	Turnover TR/TA	FA/TA (Adjusted)
A-E Totals	346	1,541,657	800,952	1.92	0.21
Construction Totals	2285	14,720,200	5,799,504	2.54	0.175
Concrete	45*	164,392*	63,752*	2.58	0.19
Electrical	271	1,056,965	401,068	2.64	0.15
Foundations	81	153,716	78,477	1.96	0.34
Floors	25	45,587	19,872	2.29	0.06
Commercial	462	6,316,125	1,985,696	3.18	0.13
Gen. Bldg.	340	1,817,855	1,079,516	1.68	0.09
Heavy	54	969,303	395,297	2.45	0.27
Highway	234	1,681,867	824,702	2.04	0.36
Masonry	60	107,116	45,437	2.36	0.12
Paint/Paper	54	141,659	54,203	2.61	0.28
Plastering	77	218,926	83,511	2.62	0.14
Plumbing	305	1,232,815	413,308	2.98	0.10
Roofing	107	228,732	79,767	2.87	0.14
Steel	65	206,437	107,535	1.92	0.24
Terrazzo	19	23,847	8,138	2.93	0.09
Water	86	354,858	159,227	2.23	0.27

* Data in the remainder of these columns are from *Statement Studies*, copyright 1976, Robert Morris Associates.

Disclaimer Statement. RMA cannot emphasize too strongly that their composite figures for each industry may not be representative of that entire industry (except by coincidence), for the following reasons:

1. The only companies with a chance of being included in their study in the first place are those for whom their submitting banks have recent figures.

2. Even from this restricted group of potentially includable companies, those which are chosen, and the total number chosen, are not determined in any random or otherwise statistically reliable manner.

3. Many companies in their study have varied product lines; they are "mini-conglomerates," if you will. All they can do in these cases is categorize them by their primary product line, and be willing to tolerate any "impurities" thereby introduced.

In a word, don't automatically consider their figures as representative norms and don't attach any more or less significance to them than is indicated by the unique aspects of the data collection.

very cumbersome to have a separate profit procedure for each industry type, and since most Corps projects involve more than one type of industry (e.g., electrical, plumbing), it would be even more impractical. In applying the proposed profit procedure, the problem of "over-rewarding" the high-turnover industries is mitigated by the fact that the work engaged in by most such industries is less risky -- and therefore usually weighted lower -- than the work associated with industries having lower turnovers. On the other hand, industries with turnovers much less than 2.5 would be severely penalized since their effective ceiling rate of return would be less than 30 percent. For such situations an empirical adjustment is applied to the construction calibration results to provide additional incentive, as described on p 65. With respect to the A-E industry, dividing the 30 percent ROI ceiling rate by an average turnover of 2.0 yields a markup ceiling of 15 percent.

Table J2

1977 Business Statistics For Some Construction and A-E Firms

Industry	Number of Firms	Total Revenue ($1000)	Total Assets ($1000)	Turnover TR/TA	FA/TA (Adjusted)
A-E Totals	372	2,041,798	977,995	2.09	0.22
Construction	2312	14,255,364	5,900,999	2.42	0.193
Concrete	45*	155,087*	60,391*	2.58	0.28
Electrical	257	1,407,255	547,980	2.64	0.12
Foundations	87	248,130	143,986	1.72	0.40
Floors	20	46,793	21,420	2.18	0.08
Commercial	469	4,670,827	1,653,366	2.83	0.13
Gen. Bldg.	355	1,790,677	1,047,487	1.68	0.11
Heavy	58	947,612	374,035	2.45	0.32
Highway	231	2,123,973	957,343	2.22	0.37
Masonry	56	113,041	48,524	2.33	0.23
Paint/Paper	53	86,320	32,260	2.68	0.17
Plastering	81	343,524	108,634	3.16	0.10
Plumbing	337	1,338,811	466,625	2.87	0.12
Roofing	103	270,065	91,738	2.87	0.16
Steel	48	274,142	143,980	1.92	0.26
Terrazzo	22	42,066	15,787	2.66	0.12
Water	90	397,041	187,443	2.12	0.29

* Data in the remainder of these columns are from *Statement Studies*, copyright 1977, Robert Morris Associates.

Disclaimer Statement. RMA cannot emphasize too strongly that their composite figures for each industry may not be representative of that entire industry (except by coincidence), for the following reasons:

1. The only companies with a chance of being included in their study in the first place are those for whom their submitting banks have recent figures.

2. Even from this restricted group of potentially includable companies, those which are chosen, and the total number chosen, are not determined in any random or otherwise statistically reliable manner.

3. Many companies in their study have varied product lines; they are "mini-conglomerates," if you will. All they can do in these cases is categorize them by their primary product line, and be willing to tolerate any "impurities" thereby introduced.

In a word, don't automatically consider their figures as representative norms and don't attach any more or less significance to them than is indicated by the unique aspects of the data collection.

The amount of the ceiling markup to be allocated to the Risk-Free portion of the return and to the Premium for Risk portion must be decided next. The Risk-Free Return should be comparable to rates of return offered by relatively risk-free investment opportunities. Conventional new home mortgage rates are assumed to be an appropriate measure of such opportunity. Such mortgage rates varied from 7.6 percent in 1972 to 9.0 percent in 1977. During the same period, the interest rate determined by the Secretary of Treasury, as directed by PL 92-41, varied from 6-3/4 percent in 1972 to 7-7/8 percent in 1977. Therefore, the PL 92-41 rate is used as a convenient and reasonable indicator of such risk-free market opportunities. The

Treasury rate is adjusted semiannually and is accurate enough to be used with the proposed profit procedure. The risk-free markup component appropriate to a particular Treasury rate of return is based on the formula:

$$\text{markup (m)} = \text{ROI/Turnover}$$

or,

$$m = \text{ROI} \times (1/\text{Turnover})$$

For the construction industry, the inverse of a turnover of 2.5 is 0.4, which is the fixed weight assigned to the Base Incentive profit factor of the recommended method. When this weight is applied to the 1972 PL 92-41 rate of 6.8 percent, a markup value of 2.7 percent results for this factor. When the fixed weight of 0.4 is applied to the 1979 PL 92-41 rate of 10 percent, a markup value of 4 percent results. For the A-E industry, the inverse of a turnover of 2.0 is 0.5, which is the fixed weight assigned to the Base Incentive profit factor in the recommended method. When this weight is applied to the 1972 PL 92-41 rate of 6.8 percent, a markup value of 3.4 percent results for this factor. When the fixed weight is applied to the 1979 PL 92-41 rate of 10 percent, a markup value of 5 percent results. The markups resulting from the 1979 PL 92-41 rate are arbitrarily used to continue the calibration.

The next step in calibrating the construction model is to determine how much of the remaining 8 percent markup (i.e., 12 percent minus 4 percent) should be assigned to the Fixed Asset Investment factor. An analysis of the RMA data for about 2300 construction firms shows that an average of about 18.4 percent of construction industry assets are fixed assets. (Intangible assets such as good will and patents are excluded in this calculation.) The construction process may be viewed as one of investing construction assets -- funds and facilities -- in construction projects to earn an ROI on those assets. It is assumed that Premium for Risk should be distributed in proportion to the amount of fixed assets (facilities and equipment) required versus current assets (funds) required. The remaining 8 percent markup is distributed in proportion to the average asset distribution within the construction industry. This results in 1.5 percent (8 percent x 0.184) being assigned to the Fixed Asset factor. It is to this 1.5 percent that the empirical adjustment mentioned before is applied. An analysis of RMA data to determine the effect of assigning only 1.5 percent to the Fixed Asset factor reveals that industries that have a higher-than-average fixed asset investment as a general rule also have a lower turnover rate. The result is that such industries would receive less ROI than "average" construction industries for a given markup ceiling. To compensate for this, therefore, 3.0 percent is added to the Fixed Asset factor. By associating this 3.0 percent only with the Fixed Asset factor, just those projects requiring industries with high fixed asset investments will qualify for the additional incentive. The overall effect of this adjustment is to raise the effective construction ceiling markup from 12 to 15 percent when rating "fixed asset heavy" projects. An ROI of 30 percent divided by a markup of 15 percent yields a turnover of 2. For comparison, the Internal Revenue Service (IRS) 10-year (1965 to 1974) average turnover for the construction industry is also 2 (Table J3). Note that while the calibration of this factor is based on industry statistics, the application of it is based on the particular characteristics of the project. A balance of 6.5 percent markup (8 percent minus 1-1/2 percent), remains to be distributed across the remaining four construction factors: Duration, Type of Contract, Relative Difficulty of Work, and Contractor Participation.

The graph in Figure H1 is used to assign appropriate weights to the Fixed Asset Investment factor. The graph is based on the concepts that jobs requiring greater use of fixed assets should be rewarded proportionally more than jobs requiring less use of fixed assets, and that the reward should also be proportional to the relative investment risk of the types of fixed assets used on a particular job. Therefore, equipment-intensive work is assigned to the High Investment Band of the Fixed Asset Investment graph and is rewarded more than is labor-intensive work, which is assigned to the Low Investment Band. The lowest fixed asset

Table J3

Internal Revenue Service Contract Construction Industry Statistics (1965 to 1974)

Size of Firm Total Assets ($1000)	No. of Firms	Cumulative Receipts ($1000)	Cumulative Total Assets ($1000)	Turnover (Receipts/ Assets)
< 100	84,216	10,449,010	2,696,091	3.9
100 - 500	45,150	22,751,281	8,841,451	2.6
500 - 1000	9,597	12,216,148	5,285,653	2.3
1000 - 5000	7,722	22,507,361	1,335,445	2.0
5000 - 10,000	796	6,951,600	4,025,389	1.7
10,000 - 50,000	408	8,136,535	5,825,247	1.4
50,000 - 100,000	29	1,979,109	1,814,918	1.1
> 100,000	28	5,461,624	5,194,849	1.1
Totals	147,948	90,452,867	45,019,037	2.0

investment risks are defined to have a risk index of 1; the highest, a risk index of 10. Jobs with a risk index of 1 are rewarded 0.14 as much as jobs with a risk index rating of 10, assuming the investment levels are the same. For ease of graphing, a linear distribution of reward is defined between these two extremes. The ratio 0.14 is used in recognition of the following relationships: assuming linear depreciation, a "profit" markup of 223 percent of annual depreciation is required to obtain a 30 percent ROI over a 10-year investment life; similarly, a 30 percent markup is required over a 1-year investment life. The ratio of 30 to 223 is 0.14.

Consideration of a Fixed Asset Investment factor is not appropriate to the determination of a profit objective for A-E contracts, because unlike construction contracts, the intensity of fixed asset use on A-E jobs is relatively constant. Therefore, consideration of a Fixed Asset investment factor does not meaningfully discriminate among the risks of different A-E jobs. If, however, an adjustment to the profit objective should be required by Cost Accounting Standard (CAS) 414 because of Cost of Facilities Capital considerations, CERL recommends that one fifth of the total profit objective be attributed to the use of fixed asset investments.[7] This is based on an analysis of RMA data on some 350 A-E firms for the years 1976 and 1977 -- data which show that the ratio of the average A-E firm's fixed assets (excluding intangibles and "all other" noncurrent assets) to total assets (excluding the same two categories) is about 1 to 5 (Tables J1 and J2). Therefore, one-fifth of the base incentive should be disallowed if separate cost of Facilities Capital allowances are made under CAS 414.

The Duration factor recognizes that retainage practices reduce a contractor's effective ROI and that jobs of long duration are more risky than shorter projects because of the increased uncertainties of anticipating the future. The following example is used to estimate how much of the remaining markup should be assigned to the Duration factor. Assume a hypothetical 1-year contract for which one twelfth of the contract price is earned each month for 12 months. Further assume that one tenth of the earnings are retained until the project is 50 percent complete, i.e. during the first half year; and that for the last half year, only 5 percent of the total contract amount is retained throughout the 6 months. Assume that 18 percent is a fair return on the retained portion of the earnings. For the situation described, an additional incentive of 0.7 percent of contract price (P) must be allowed to provide the same incentive to the

[7] "Cost Accounting Standard -- Cost of Money as an Element of the Cost of Facilities Capital," *Code of Federal Regulations*, Vol 4, Part 414 (January 1, 1979).

contractor as would be provided if there were no retained earnings. The 0.7 percent was computed as follows:

$$(0.18)\ [(1/2)\ (0.05P)\ (1/2\ yr) + (0.05P)\ (1/2\ yr)] = 0.7 \text{ percent times P.}$$

The 2-year rate is 1.4 percent. Since the calibration rationale is based on an annual rate of return, 5.8 percent (6.5 minus 0.7 percent) remains to be distributed across the three remaining construction profit factors. Similarly, 9.3 percent (10 minus 0.7 percent) remains to be distributed across the three remaining A-E profit factors.

The Type of Contract factor recognizes that a firm's exposure to risk is also a function of the terms of the contract. The Logistics Management Institute (LMI), in its report, *A Uniform Profit Policy For Government Acquisition*, provides as good an argument as any in support of a 3 percent spread between Cost Plus Fixed Fee and Firm Fixed Price contracts.[8] LMI admits that the size of the spread is primarily judgmental. The LMI procedure is for industries with an average turnover of 1.65. Since the representative turnover used in the construction calibration is 2.5, the following adjustment is made to the 3 percent spread proposed by LMI: (3 percent x 1.65)/(2.5) = 2 percent. The distribution of the 2 percent spread across intermediate contract types is arbitrary. A balance of 3.8 percent (5.8 percent minus 2 percent) remains to be distributed across the remaining two construction profit factors. For the A-E industry, the following adjustment is made: (3 percent x 1.65)/(2.0) = 2.5 percent. A balance of 6.8 percent (9.3 minus 2.5 percent) remains to be distributed across the two remaining A-E profit factors.

Both remaining factors -- Relative Difficulty of Work and Contractor Participation -- address the performance risks related to the nature of the work itself. As described in the recommended procedure, the percentage of work performed by the contractor is also a consideration in selecting an appropriate weight for the Relative Difficulty of Work factor. That is, since the Contractor Participation factor's weight is already determined for the negotiator, it should not be assigned a rate of more than half that assigned to Relative Difficulty of Work. Thus, the negotiator is allowed more flexibility than if equal rates were assigned to both factors. Therefore, the remaining 3.8 percent for construction is arbitrarily distributed with 2.6 percent assigned to the Relative Difficulty factor and 1.2 percent to the Participation factor. Similarly, rates of 4.6 and 2.2 percent are arbitrarily assigned to Relative Difficulty and Contractor Participation, respectively, for A-E contracts.

The graphical A-E profit method is calibrated to yield generally the same results as the basic A-E profit method. However, to improve graph readability and to eliminate Contractor Participation and Base Incentive as additional dimensions of the graph, certain approximations are made. The maximum percent allowed on the Fixed Price portion of the graph is based on the most generous markup allowance of the basic profit method -- i.e., 15.7 percent. This rate is reduced slightly to 15.5 percent to simplify the graph. The slope of the Relative Difficulty curves is 1.5 percent over 24 months versus 1.4 percent per 24 months provided in the basic profit method; again, this was done to simplify the graph. The point spread between each of the Relative Difficulty curves is 2 percent for a total spread of 6 percent from simple to complex. The 6 percent is considered to be the sum of the 4.6 percent attributable to the Relative Difficulty factor of the basic method and 1.4 percent attributable to the Contractor Participation factor of the basic method as evaluated at about the 72 percent participation level. The Cost Plus portion of the graph is the same as the Fixed Price portion, but at rates which are 2.5 percent less than the corresponding fixed price rates.

[8] Robert K. Wood, Myron G. Myers, and M. Brian McDonald, *A Uniform Profit Policy for Government Acquisition* (Logistics Management Institute, December 1978).

APPENDIX K:

RESULTS OF TESTING PROFIT PROPOSAL I

Profit Proposal I was tested on 30 contracts in 2 districts by 15 contracting officers. The test results are tabulated in Table K1. Column 1 of Table K1 provides a reference number to identify each contract that was rated. To ensure the anonymity of the raters, a letter code in column 2 designates the person rating the contract. In column 3 is the profit objective that the rater considered reasonable. In column 4 are the profit objectives that were actually derived by the raters using Proposal I, and in column 5 are adjusted profit objectives derived by CERL using the recommended profit procedure. The column 5 profit objectives are primarily the result of CERL's applying to the recommended profit procedure the weights and parameters applied by the respective raters when they used Proposal I. However, some of the rater-assigned weights have been adjusted by CERL.

In Proposal I, a weight from 0.7 to 1 can be used to rate Firm Fixed Price contracts. But in the recommended proposal, an adjusted weight of 1 was assigned to all Firm Fixed Price contracts. The factor Management Risks was deleted. Therefore, the weight for the Relative Difficulty factor in the new procedure was adjusted to equal the average of the weights assigned by the raters to the Relative Difficulty and Management Risks factors of Proposal I. Furthermore, if the prime contractor was functioning only as a broker, a weight of 0.1 was assigned to the new Relative Difficulty factor.

In some cases, it was obvious that the duration of the basic project was erroneously used in rating change-order work. In these cases, the duration of the change-order work was estimated and the appropriate weight adjustment made. Several obvious errors in the computation of the percent of contractor participation were detected; these errors were corrected on the basis of the cost information provided, and the appropriate factor weight adjustments were made.

The Fixed Asset Investment factor was frequently misinterpreted by the raters. Based on the descriptions provided in the scope of work and on the rater's comments in the remarks column of the Proposal I rating form, corrected weights were applied to certain Fixed Asset Investment factors. For example, in cases where the prime contractor was functioning only as a broker for subcontractor services, an adjusted weight of 0 was assigned to the Fixed Asset Investment factor. To alleviate the problem of misusing this factor, an explanation of how to apply it correctly has been developed for inclusion in the *Construction Contract Negotiating Guide* if the recommended procedures are adopted by OCE.[9]

Overall average results for relevant columns are recorded at the bottom of those columns. There is a 1.1 percent difference between the overall average profit objective recommended by the raters and the overall average profit objective actually derived by the raters using Proposal I (8.8 versus 9.9 percent). Applying the recommended profit procedure and using adjusted weights, where appropriate, reduces the overall average profit objective on the 30 contracts to 8.6 percent, which is very close to the 8.8 percent average recommended profit.

[9] *Construction Contract Negotiating Guide: FY79 Edition* (DA, OCE, 1979).

Table K1

Profit Objectives for Weighted Factor Methods (Construction Contracts)

Ref No.	Rater	Reasonable Profit (%)	Proposal I Profit (%)	Recommended Method Profit (%)
1	A	10.0	10.0	8.2
2	A	12.1	12.1	8.4
3	A	12.7	12.7	9.0
4	A	13.8	13.8	9.0
5	B	5.6	5.6	7.6
6	B	12.1	12.1	9.2
7	C	4.9	4.9	5.0
8	C	10.5	10.5	8.0
9	D	5.7	8.5	6.9
10	D	8.6	9.1	9.9
11	E	10.2	10.2	10.8
12	E	10.2	10.2	10.1
13	F	7.7	7.7	8.5
14	G	7.0	9.7	9.0
15	G	8.0	9.9	8.9
16	H	8.5	9.8	8.4
17	H	7.8	10.3	8.3
18	H	7.8	10.4	8.3
19	I	8.4	8.4	9.3
20	I	11.4	11.4	11.8
21	J	10.3	10.3	9.0
22	J	9.8	10.8	9.7
23	K	7.8	7.8	8.3
24	K	9.3	9.3	8.9
25	L	9.5	9.5	9.2
26	L	11.2	11.2	9.8
27	M	5.0	10.9	6.4
28	M	7.0	13.3	9.5
29	N	7.0	8.5	6.4
30	O	4.5	8.1	6.3
	Overall Averages:	8.8	9.9	8.6

APPENDIX L:

RESULTS OF TESTING PROFIT PROPOSALS J AND K

Profit Proposals J and K were tested on 55 contracts in 3 districts by 11 contracting officers. Proposal J was used on 28 contracts by 9 of the raters; Proposal K was used on 44 contracts by 10 raters. Both Proposal J and Proposal K were used by 4 of the raters on 17 contracts. The test results are tabulated in Tables L1 and L2 for Proposals J and K, respectively.

Column 1 of Tables L1 and L2 provides reference numbers to identify each contract that was rated. Note that the reference numbers 39 through 55 appear in both tables. These numbers represent the 17 contracts that were tested using both Proposal J and Proposal K. To retain the anonymity of the raters, a letter code in column 2 designates the person rating the contract. In column 3 are the profit objectives that the raters considered reasonable. In column 4 are the profit objectives actually derived by the raters using either Proposal J or Proposal K, and in column 5 are the profit objectives derived by CERL using the recommended profit procedures. The column 5 profit objectives are the result of applying to the recommended profit procedures the weights and parameters applied by the respective raters when they used Proposals J and K. CERL made certain adjustments only to the factor weights used to derive the profit objectives in column 5 of Table L1. These adjustments resulted from making obviously needed corrections to the actual weights assigned by the raters. The corrections were applied to account for two basic differences between Proposal J and the recommended weighted profit factors procedure. First, in Proposal J, the raters could select a weight from 0.7 to 1.0 for Firm Fixed Price contracts. In the recommended procedure, Firm Fixed Price contracts were always rated 1; thus, on those contracts for which the Type of Contract factor was rated less than 1, the weight was adjusted to 1 for the Type of Contract factor. Second, in Proposal J, the Duration of Project factor considered a time range of 12 months; the revised procedure considers a time range of 24 months for the corresponding profit factor, Duration of Work. This adjustment halved the weight of the Duration of Project factor.

The overall average results for relevant columns in Tables L1 and L2 are recorded at the bottom of those columns; the average results for the 17 contracts with reference numbers 39 to 55 are also given. Table L1 shows that there is a 2.1 percent difference between the overall average profit objective recommended by the raters and the overall average profit objective actually derived using Proposal J (12.2 versus 10.1 percent). The effect of using the recommended weighted profit factors procedure is to raise the average overall profit objective from 10.1 to 12.8 percent. The effect of using the recommended procedures on the 17 contracts numbered 39 to 55 is to raise the average profit objective from 10 percent to 12.3 percent. Table L2 shows that there is a 4.2 percent difference between the overall average profit objective recommended by the raters and the overall average profit objective actually derived using Proposal K (12.9 versus 8.7 percent). This difference is significantly greater than the corresponding 2.1 perce · difference for Proposal J because rater "C," who used only Proposal K, assigned a recommended profit objective of 15 percent in 11 of 13 cases. Rater "C" appears to prefer an "across the board" profit objective of 15 percent, regardless of the degree of difficulty or other considerations.

Note, however, that for contracts 39 to 55, the average difference between the profit objective considered reasonable and the profit objective obtained using Proposal K is only 1.8 percent; this difference is compatible with the corresponding 2.1 percent difference in Table L1. The effect of using the recommended graphical procedure is to raise the average profit objective from 8.7 to 11.2 percent. On the subset of 17 contracts numbered 39 to 55, the effect is to raise the average profit objective from 10.3 to 12.4 percent, which is very close to the average recommended profit. A comparison of Table L1 and Table L2 results for the 17 contracts

numbered 39 to 55 indicates that the recommended graphical procedure yields results that are comparable to the recommended weighted profit factors procedure.

Table L1

Profit Objectives for Weighted Factor Methods (A-E Contracts)

Ref. No.	Rater	Reasonable Profit (%)	Proposal J Profit (%)	Recommended Method Profit (%)
2	B	9.8	9.8	12.6
20	D	14.0	10.2	13.8
21	D	15.0	10.7	13.6
22	D	12.0	10.9	14.2
23	D	14.0	11.3	14.2
27	E	12.0	10.9	14.1
31	F	10.0	10.0	13.2
32	F,G	12.0	10.5	13.8
36	G	12.0	9.3	12.4
37	G	15.0	9.3	12.2
38	G	10.0	10.5	13.7
39	H	12.1	9.2	11.6
40	H	13.3	9.4	11.3
41	H	12.7	9.8	12.1
42	H	13.6	10.1	12.6
43	H	13.5	10.2	12.3
44	I	12.0	10.0	12.1
45	I	12.2	11.3	14.1
46	J	12.0	8.4	10.5
47	J	11.5	8.5	10.9
48	J	11.5	8.7	10.9
49	J	12.0	9.3	11.7
50	J	12.0	9.3	11.5
51	K	10.4	10.3	13.0
52	K	10.5	10.5	13.0
53	K	10.8	10.8	13.0
54	K	13.0	12.3	14.1
55	K	12.3	12.3	14.9
	Overall Averages:	12.2	10.1	12.8
	Averages for Contracts 39-55:	12.1	10.0	12.3

Table L2

Profit Objectives for Graphical Profit Methods (A-E Contracts)

Ref. No.	Rater	Reasonable Profit (%)	Proposal K Profit (%)	Recommended Method Profit (%)
1	A	10.0	9.0	10.7
3	C	12.0	7.0	10.3
4	C	15.0	7.1	10.1
5	C	15.0	7.1	10.0
6	C	15.0	7.1	10.0
7	C	15.0	7.2	10.2
8	C	15.0	7.2	10.2
9	C	15.0	7.2	10.2
10	C	10.0	7.4	10.3
11	C	15.0	7.6	10.3
12	C	15.0	7.7	10.3
13	C	15.0	9.6	12.2
14	C	15.0	9.7	12.2
15	C	15.0	9.9	12.3
16	D	10.0	7.2	10.2
17	D	15.0	7.7	10.3
18	D	15.0	7.8	10.3
19	D	15.0	8.2	12.4
24	E	15.0	7.4	10.2
25	E	12.0	7.5	10.2
26	E	12.0	7.8	10.2
28	F	15.0	7.1	10.1
29	F	12.5	7.5	10.1
30	F	10.0	8.0	10.5
33	G	10.0	5.3	8.0
34	G	10.0	7.1	10.1
35	G	12.0	7.2	10.1
39	H	12.1	8.7	10.7
40	H	13.3	9.0	10.8
41	H	12.7	10.0	12.8
42	H	13.6	10.8	12.7
43	H	13.5	10.0	12.8
44	I	12.0	9.2	11.2
45	I	12.2	12.0	14.5
46	J	12.0	10.0	10.3
47	J	11.5	10.0	12.4
48	J	11.5	8.1	10.3
49	J	12.0	9.0	11.3
50	J	12.0	10.0	12.5
51	K	10.4	10.4	12.5
52	K	10.5	10.5	12.5
53	K	10.8	10.8	12.8
54	K	13.0	13.0	14.8
55	K	12.3	13.0	15.2
	Overall Averages	12.9	8.7	11.2
	Averages for Contracts 39-55	12.1	10.3	12.4

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